The Chemical Age

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Notes and Comments

The Budget and Chemical Industry

THE chemical industry has little special interest in the Budget other than that possessed in common by the majority of business men of a relief in the income tax. That is in itself important, though there may be ground for believing that a reduction in the super-tax might have been even more potent in assisting trade recovery. Whilst the tax reduction will stimulate confidence in the home market, it must not be forgotten that industry is initiated and financed by the super-tax payers rather than by those who earn moderate incomes. Prior to this Budget a rich man could not consider investing money in any new enterprise unless the prospects were extraordinarily good. If the actual yield were to be 10 per cent.—and that is not bad in these days—the rich investor would only receive 3 per cent. on his money by the time he had paid taxes. The return was not sufficient to encourage him to start new businesses. It is a pity that socialistic legislation still considers the capitalist as the normal prey of the Exchequer. We trust, however, that the relief here given will be sufficient to enable enterprises that still hang fire to be proceeded with.

The more direct effect of the Budget on the chemical industry lies in its relation to oil. The Chancellor looks to expanding trade to provide £42,700,000 from the oil duties. Analysis shows that of a total cost of 1s. 5d. for petrol, tax accounts for 8d., distribution (including the capital cost of distribution plant bought in this country) is 6d., whilst the remaining 3d. is partly expended in tankers (British) and in paying dividends to British capital. These are Dr. Dunstan's figures, and appear to "knock the bottom" out of the "imported oil" cry.

Safety in the Works

WE never tire of discussing safety in works, because the human problem is predominantly the most important. We have in past issues discussed Government orders, works measures and the responsibilities of engineers and their employers; all are important and the combined effect may be seen from a perusal of technical literature of the last century. Never a week passed without its distressingly large toll of human lives. Boilers burst, killing up to four or five people each time, every week. Explosions of all types were common; colliery disasters occurred several times a year and were only considered worthy of special note if more than twenty or thirty were killed—otherwise they were "just another accident." In a text-book dated 1877 details were given of the first explosion of a gasholder (at Manchester in 1819) and it was remarked that "Happily such catastrophes are *now less frequent* than formerly." The records of the chemical industry show a similar improvement. However much the Government may legislate, however great may be the precautions taken by engineers, one factor remains which is the cause of the greater number of accidents and which neither of the governing parties can touch directly—we refer to the men themselves. It seems to be a failing—or is it a virtue?—of the human race to be optimistic, never to believe that any possible ill can happen to them individually, until it has happened. That is why the workman will have nothing to do with safety devices provided for his use. That is what led a gentleman in clogs, we heard of last week, to do a step dance on the wall that had been specially built round a tank of hot water for his particular safety—he is still in hospital. Self-confidence is one of the great forces of human life, but like other great forces it must be governed and directed rather than allowed to function unchecked. One of our greatest problems, not only in industry but in all walks of life, is to persuade people to use their self-confidence with circumspection.

The feeling that the human element is itself responsible for many of the disasters that befall it must not lead to any relaxation in the efforts of engineers to preserve their men from the penalty of their own foolishness. The tragic disaster at the Billingham Drikold plant, which up to the time of writing has resulting in eleven deaths, shows—if demonstration were needed—that no relaxation in precautions can ever be possible. Even with the elaborate precautions taken at Billingham, occasional accidents cannot yet be avoided, though in time we must hope to evolve methods of inspection and housing of plant that will render such occurrences as rare as a total eclipse of the sun, and that will ensure (when they occur) that all operators are in a position of safety. The moral for the smaller works is clear; safety precautions are not so thorough at many of these places as at the larger works. The dangers involved by working with many of the commonest substances are not always appreciated until an accident on a major scale draws attention to them.

Poor King Coal !

COMMUNICATIONS to the Royal Society of Arts, as a rule, are well-considered, accurately informative, authoritative or constructive pronouncements. A paper such as that read by the Director of the Coal Utilisation Council, on April 18, on "The Utilisation of Coal," was far below the usual standard. A mass of crude statement, little more than a schoolboy's loosely strung essay on the uses of coal, it has no public value. In no country but ours could a matter of such grave national concern be handled so crudely. Coal unfortunately has always been our industrial Cinderella, her parentage unthought of, her Sun-begotten power unrecognised; the scientifically equipped Prince who will raise her to her proper place and rank has yet to come forward. Present public disregard and ignorance are a grave reflection upon the teaching of natural science in our schools; nothing useful is learnt of coal.

As often happens when a paper without substance is read, subsequent speakers contributed not a little to save the situation and make the evening interesting by bringing out essential points. In opening the discussion, Mr. H. C. Armstrong, who has had charge of the fuel department of one of our largest steel works during the past dozen years, laid emphasis upon the pressing need of a standard set of names for coals, one which could be understood by all. Many important properties were shown in the analysis that were never mentioned by the coal salesmen. Attention was rarely given to the ash-fusion-point, often a matter of first consequence. Coal in its raw state represents heat energy of a very high order; nevertheless, the thermal efficiencies obtained in industry are often very low. Here was work for a really knowledgeable Council to show where saving can be made. Were results forthcoming, however, they would be a bitter pill for the coal owners to swallow; new knowledge must inevitably lead to less, rather than more, being used.

A Real Analysis Needed

A REAL analysis of the coal situation would be of immense value at the present time. A maze of complexities, conflicting interests and widespread lack of knowledge of the material itself, the problems of the industry can only be dealt with by experienced hands; no one who is not fully and specially trained to the service of his Black Majesty can undertake the task. Let us hope the Society may be led to arrange for a symposium at as early a date as possible: it can render no greater service. The Coal Utilisation Council, a body of coal owners and distributors, has undertaken a herculean task, of national importance; it cannot, however, with its present constitution, be regarded as a competent tribunal to bring the affairs of the industry into scientific order and to consider the realities of coal utilisation.

The position of the coal owners is one of extraordinary difficulty and if the industry is to be brought, in any way, under national control, it is essential that its problems should be comprehensively as well as intelligently considered. No self-appointed body will do what is needed. Such a body is sure to be representative of interests rather than of knowledge. A free-lance discussion, such as the Royal Society of Arts could organise, is far more likely to produce results. Experience could not be excluded in the way that it has been hitherto from the inquiries—by the Fuel Research Board, for example.

The reader of the paper spoke of his Council undertaking educational propaganda amongst parents and schools, "where unfortunately there appears to be a widespread and entirely erroneous impression that the coal industry is dying." A publicity mania is upon us at present: even the glass of beer has to be advertised down our throats. The worm must turn somewhere: let it be at coal. That such innocence of outlook—the author, at the outset, stated that he was not a technician—could be displayed upon a public platform is sufficient proof of our inability to take our industrial problems seriously.

Water Shortage

WATER is one of the principal raw materials of industry. It is used for widely varying purposes by every factory in the country, and an insufficiency would be more harmful than an insufficiency, for example, of iron ore or sulphur. These are facts that many have hardly realised, because water, like the poor, is ever with us. Problems of river pollution will become increasingly important as the volume of the rivers diminishes and as additional sources of drinking water are sought. When a river is at normal flow the water that has been taken from it by works situated on its banks—water that has been boiled, cooled, evaporated, condensed, added, extracted, and in the process has generally picked up some impurities not there previously—can be returned without detriment to anyone; but when the flow is reduced to a mere trickle the impurities are far more important.

In many quarters the solution of our difficulties has been pronounced to lie in a water grid. The South Yorkshire Gas Grid and the Electricity Grid have set a fashion in "Grids." What could be more satisfying than pipe lines permeating the whole country to bring us every "fluid" we need—gas, electricity, water, beer, milk and a hundred others? Unfortunately there is a snag—cost of conveyance. A water grid would be of little or no value to industry. There can be little amelioration in the present circumstances for industrial users, save whatever action they may take themselves. Many large water users, especially in hot countries, maintain their own reservoirs the water being circulated continuously from the storage ponds to the works; many collieries have similar reservoirs, in their case frequently as a means of cooling the water cheaply as well as of storage. In many works water is being used wastefully; cooling plant is not as efficient as it might be, and an additional cooler here and there would greatly reduce the flow of water through the plant. The works engineer might well look upon efficiency from the new angle of water conservation; he will be surprised when he finds the many ways in which less water could be used. Not only will a contribution be thus made to the water problem, but he will reduce pumping costs, fuel costs and so on, thus making a real and lasting contribution to the reduction in costs throughout the works. Finally, attention might be paid to the purification of the water sent down to the rivers.

Death of Sir Max Muspratt

The Chemical Industry Loses a Distinguished Leader

By the death of Sir Max Muspratt, which occurred at his home, The Grange, Fulwood Park, Liverpool, on April 20, the chemical industry has lost one of its best known leaders, and the city of Liverpool has lost an able civic administrator and a public-spirited citizen. Sir Max, who was 62 years of age, underwent an operation for internal trouble on April 19, but succumbed early the following morning. He and Lady Muspratt were to have sailed for Spain this week. There is no heir to the baronetcy, which was conferred in 1922 in recognition of war services. Mr. Rudolph Muspratt, son of Sir Max and Lady Muspratt, died following an operation for appendicitis in 1929, and his twin sons (grandsons of Sir Max) were born two months later, but died in infancy.

One hundred and eleven years ago, in 1823, James Muspratt, grandfather of Sir Max, established the first alkali works in this country, first in Liverpool and later in Widnes, where in course of time the undertaking became the United Alkali Works. The company was developed by his father, Dr. E. K. Muspratt, and later controlled by him for a number of years before becoming part of Imperial Chemical Industries, Ltd.

The second son of Dr. E. K. Muspratt, Sir Max was born at Seaforth Hall, Liverpool, on February 3, 1872, and was educated at Hemel Hempstead and Clifton College. It was, however, at Zurich that he received the scientific training as a chemist which his father regarded as essential for one destined to sustain the family business traditions. At Zurich he was one of the earliest Englishmen to obtain the Swiss Government's Diploma in Industrial Chemistry. He returned to England in 1895 and entered the United Alkali Works at Widnes, then under the direction of his father, and after taking an active part in the administration of the technical side he became a director in 1901, becoming chairman thirteen years later.

The late Sir Max Muspratt.

On the outbreak of war, Sir Max played an onerous part in helping to equip the fighting forces and was appointed in August, 1914, a member of the special committee on explosives created by Lord Haldane. He worked in the closest touch with the Ministry of Munitions, where his advice on chemical warfare was greatly valued, and it was mainly in recognition of his services in this respect that he was created a baronet in 1922.

Sir Max Muspratt was chairman of the Association of British Chemical Manufacturers in 1924, and when Imperial Chemical Industries, Ltd., was formed he became one of its directors. To research and technical equipment in industry, Sir Max always attached the utmost importance, and within the United Alkali Co., which now forms part of Imperial Chemical Industries, Ltd., he built up a large and highly efficient research organisation. During the whole period of his chairmanship of the United Alkali Co. there was never a stoppage of work arising from a strike among the company's employees, despite disturbed conditions in other trades.

It was at Widnes that Sir Max began his political activities nearly 40 years ago, and later extended them to Liverpool and the Midlands. He had a long connection with the city council of Liverpool, entering it in 1903 and becoming an alderman, and was at his death chairman of the finance committee. In that capacity he was concerned with the corporation loan which was launched this month. For many years he was leader of the Liberals on Mersey-side, and his withdrawal in 1926 was a serious loss to the party. He had a brief experience of Parliament; he was elected Liberal member for the Exchange Division of Liverpool at the general election of January, 1910, but was defeated in the following December. He fought the Bootle Division against Mr. Bonar Law in 1911, but without success, and that was his last attempt to enter the House of Commons. He was Lord Mayor of Liverpool in 1916-17, a member of the Liverpool University Council and of the Mersey Docks and Harbour Board, and a director of a number of limited liability companies.

Among the many positions of honour to which Sir Max Muspratt attained in the business world the one that he valued most was probably that of the president of the Federation of British Industries from 1926 to 1927. He had also been vice-president of the Society of Chemical Industry, president of the Widnes Chamber of Commerce, chairman of the Liverpool and District Economic League, and chairman of the Lord Mayor's Committee on the Trade of the Port. Other positions held by him had been that of director of the Liverpool Daily Post and Echo, Ltd.; the Automatic Telephone Manufacturing Co., Ltd.; Sunsheen, Ltd., and Western Viscose Silk Mills, Ltd. On the political side he was latterly chairman of the Wavertree Divisional Conservative Council, was a member of Lord Derby's Advisory Committee, and he succeeded the late Sir Archibald Salvidge as a member of the Mersey Tunnel Committee. He was a justice of the peace for Lancashire, and was a member of the Council of Liverpool University.

The multiplicity of Sir Max Muspratt's contacts was reflected at the funeral service at Liverpool Cathedral on Tuesday, when nearly an hour before the cortege was due to arrive people began to assemble. The congregation represented every phase of the life of Merseyside—municipal activities, shipping, commercial and manufacturing interests, and manifold works in the cause of charity and social betterment. There was probably no one present who had not some happy recollection of association with Sir Max. The Lord Mayor of Liverpool and members of the Corporation remembered his co-operation in municipal government; the Vice-Chancellor and others representing the University, his warm interest in that place; men of commerce his great business interests and the faithfulness with which he discharged those as all other trusts, whether obligatory or voluntary, and there were others there because they had lost a treasured friendship.

In his address the Bishop of Liverpool said Sir Max Muspratt served Liverpool for no reward save the satisfaction of an impulse to labour for the common good. It is a work which has many joys, and to him it brought the added joy of conspicuous achievement. It brought also many burdens and some pains. Everybody trusted him, and there was nothing selfish about his sensitiveness.

The arrival of the cortege was awaited by a large crown outside the Liverpool Crematorium in Priory Road, Anfield, where the cremation service was conducted by the Bishop of Warrington (Dr. H. Gresford Jones).

The Amalgamation of Chemical Organisations

A Candid Discussion at Newcastle

AT the annual meeting of the Newcastle Section of the Society of Chemical Industry on April 18, Mr. M. P. Applebey, manager of research, Imperial Chemical Industries, Billingham, was elected chairman for the ensuing year in succession to Professor G. R. Clemo, who became vice-chairman. Other officials elected were: Mr. J. W. Craggs, hon. secretary; Mr. B. P. Hill, hon. treasurer; committee, Dr. W. T. K. Braunholtz, Dr. J. T. Dunn (President of the Society), Dr. A. A. Hall, Mr. N. J. Iveson, Mr E. M. Myers, Professor H. L. Riley, Mr. P. D. Scott, Mr. H. Dunford Smith, Mr. F. H. Walker, Mr. W. A. Walmsley and Mr. S. A. Wikner.

After the ordinary business, Professor G. R. Clemo opened a discussion upon the affairs of the Society and of the Section in particular. He review the many efforts to secure amalgamation and showed how the industrial slump had affected progress to some extent. Later developments had resulted in a joint committee being formed, including representatives from the industry itself. A central building appeared to be out of the question, but he had hopes of something coming from a meeting to be held soon. Referring to the growth of the group system within the Society he mentioned the activity of the Chemical Engineering Group, the Food Group, the Plastics Group and the New Road and Building Materials Group. All the groups were reporting to the Council every month, but the sections were not, and there was just a danger that the groups might interfere with the sections owing to people becoming more interested in them. After all the Society owed its existence to the sections. Their own section had a remarkable and unique history and it was disquieting to find attendances too sparse.

The Drift to the South

He had analysed the papers given and found that 50 per cent. dealt with different aspects of coal. Coal had had an undue share of attention and it seemed as if they were losing man's greatest asset, curiosity, as they seemed no longer interested in questions of general chemical interest. New industries had been urged for Tyneside and they knew that scarcely any industry could be inaugurated without chemists. New industries were the responsibility of chemists. The main plank in the past had been to advertise, but his own opinion was that advertising was relatively insignificant in the matter of starting new industries. He thought the Government would have to step in and check the drift to the south, as the south might be faced with a serious water shortage. There might also be political influences at work. Had they, as chemists, done all they could? Why had special steels not been made in the north-east as well as elsewhere? The answer seemed to be that research had not been carried on sufficiently.

Dr. J. T. DUNN, president of the Society, said he did not think, in the long run, that the group system would do harm to the Society. As a fact some of the groups would have become separate organisations had they not been taken in as groups into the Society, and in at least one case it had meant a big influx of membership. There was, he admitted, a danger of splitting up into groups to the disadvantage of the Society, but it was not so great as imagined in some quarters. He though it was a reasonable criticism by Professor Clemo that their own section had not paid sufficient attention to general questions and possibly too much to particular questions. It seemed to him that there should be new small industries formed on Tyneside. At the British Industries Fair he was struck by the number of small firms exhibiting, and only one or two came from Tyneside. The reason for the dearth of new industries could not only be climatic, rates and transport problems. There was no reason why there should not be similar industries to those in, say, Walsall. Regarding special steel, they all knew they had had one member who was very active in research work on special steels and he made great advances. He believed many special steels might have been manufactured in the area had that member's directors possessed foresight and given him encouragement. It was not always the apathy of directors to blame, but in that case they might have done more.

Mr. M. P. APPLEBEY said he was still convinced that some form of amalgamation was necessary between chemical societies. What struck him in comparing the meetings of chemical societies of to-day with those of old times was the absence of young people nowadays. The reasons were twofold. Economic stress was one, but there was also less necessity to be a member of a society to have access to journals and literature. That was one of the main reasons for the falling off of young people. They had now to make an appeal to young people to join from a sense of responsibility and even gratitude. He thought there was a lack of proportion in some of the talk about industries going south. They had to distinguish carefully between large and small. He believed he was right in saying there was more chemical industry on the heavy side on the north-east coast now than ever there was. He believed the reason for industries going south was purely economic, and there was no reason to look further than that for an explanation. The element of rating alone bulked more largely than even power supplies in small industries. There was every reason for recommending that some Government control should be exercised over that side of local government costs.

Professor H. L. RILEY said that he was disappointed that so little was happening in the matter of amalgamation between societies and the thing looked like dragging on for ever. He pointed out that the cost of chemical abstracts was being largely borne by the Chemical Society and their own society; the Institute of Chemistry should recognise its responsibility more in that matter. Over half of the subscriptions of the Institute were spent in administration; that was a scandalous state of affairs. He suggested the Institute had undue importance because of its power to add a few letters after a name. Possibly the Society of Chemical Industry might solve its difficulties by allowing the letters F.S.C.I. for members.

Major HOUSTON said he agreed there were too many technical societies—but that applied to more than the chemical industry. He suggested the committee had a responsibility in the form of the papers given in a session.

Mr. J. W. CRAGGS, hon. secretary, said it was not so easy to get papers on all subjects and it was a fact that the papers on coal and allied subjects attracted the biggest attendances. Referring to the group system, he said there was a place for them in a strong, healthy section.

The Most Practical Step

Mr. E. M. MYERS said he was disappointed to see how little real progress had been made in amalgamation and he suggested that the best course would be for those societies willing to amalgamate to do so and let the others stay out if they cared to do so. That would be the most practical step. Regarding the domestic affairs of the Section, he considered that there was not sufficient encouragement given to young men to attend the meetings. Members should seek out the young men and make them feel much more at home in the section meetings.

Mr. B. P. HILL said he thought the group system was inevitable and so long as chemists had vocations they would be interested in their own work rather than in general work.

Mr. H. DUNFORD SMITH said they had been kept too much in the dark on the question of amalgamation. He considered there was too much vested interest in the official posts of the various societies and that was the real stumbling block. He agreed with Mr. Myers that if only two were prepared to amalgamate then let them do so and the others would quickly follow. He was in favour of the group system, but the groups must be kept within bounds and not allowed to rule the Society.

Mr. F. H. WALKER suggested that the committee might consider the question of approaching the Tyneside Development

Conference or some similar body and offer its assistance.

Mr. W. M. MADGIN suggested some comprehensive research into the reason for industries vanishing from the north. There were more factors than rates to be considered, and if those factors were discovered it might be possible to deal with them. Some of the favourable factors in the south, in regard to artificial silk, for instance, might easily be reproduced in the north. It should be remembered that new small industries were not starting only in places where rates were low and information should be obtained as to why they started there.

Does London Care ?

Mr. P. D. SCOTT supported Mr. Myers; let them amalgamate with those who were now willing for amalgamation. The councils in London did not seem to care whether they amalgamated or not.

Dr. GEORGE STEPHENSON said the question of amalgamation was bound up with subscriptions. What was the use of paying subscriptions to a large number of societies when they could see the journals and abstracts in the places in which they worked and, in any case, young men could not afford it.

Miss L. WALLIS said that the maintenance of interest in their own section was a question for the members themselves. They should keep in touch with the young people.

Professor CLEMO, closing the discussion, said he felt confident that the deliberations of the new council would result in something being done. He looked to the representatives of industry as a new element to make a move. He was glad Dr. Dunn was not afraid of the effects of the group system, but it had to be controlled. He agreed there ought to be Government action to restrict the moving of industries from the north. In Birmingham there was any number of subsidiary industries—everyone seemed to be on their toes and generally interested in all sorts of things, not only their immediate industry.

A resolution was passed expressing disappointment that the question of amalgamation was proceeding so slowly and urging the Council to take steps to secure amalgamation of some sort soon. It was also agreed that the Section Committee should offer its services to the Tyneside Industrial Development Conference.

Progress of the Billingham Hydrogenation Plant

To Start Production This Year

IN his speech at the annual meeting of Imperial Chemical Industries, Ltd., in London, on April, 19, Sir Harry McGowan, chairman and managing director, made an important announcement on the subject of the production of oil from coal. This was a subject that had been mentioned at almost every annual meeting of I.C.I. since its inception. A plant designed to produce 100,000 tons per annum by the hydrogenation of bituminous coal and capable of treating in addition certain quantities of high or low temperature tar was now in process of establishment. I.C.I.'s activities in this new field might be divided into technical research, production and marketing, and Government relations. Numerous obstacles had to be overcome, continuous disappointments to be borne, but science backed by patience and persistence had now, Sir Harry was convinced, won through. The patent field also offered difficulties which were cleared away by the formation of the International Hydrogenation Patents Co., which was a brilliant instance of a co-operation of world interests designed to secure the orderly development of a new industry with a great future. By it a definite market in the United Kingdom was assured for petrol made by I.C.I., who would not be concerned with distribution. Once made, the petrol would be handed over in bulk to nominated oil distributing companies, who would pay I.C.I. the net average market price.

Capital expenditure on the plant would exceed £2,500,000, which would be provided out of present liquid resources. In addition, plant at present unoccupied would be brought into use. Construction work began last autumn and the value of expenditure and orders placed up to March 31 was £1,600,000. Approximately 1,850 men were engaged on the work under some 200 managers, engineers, chemists and others, not counting about 550 men employed on the site by contractors. The total employment, direct and indirect, afforded at the moment was estimated at 13,600 men. Sir Harry expected that production would commence before the end of the present year.

Facilities for Research

Material advances had been made during the year in improving the company's facilities for research. There was still scope for development notwithstanding the large expenditure already made. The benefits from research took some time to appear in a profit and loss account, but sufficient identifiable results had been obtained from these activities to know that the expenditure is remunerative, even when judged solely from the financial point of view, apart from its vital effect on competitive efficiency. Some research efforts arose from fundamentally new discoveries. Other research sprang from a surplus of certain raw materials or by-products, or because extended markets were promised by the solution of chemical problems. If all the nutriment could be retained at a low cost in freshly-cut grass—either by silage or mechanical drying—the cattle supporting capacity of the country would be largely increased, imports of feeding stuffs would decrease and a wider market for fertilisers would follow. The company had, therefore, devoted considerable attention to grass preservation by these two methods, which were complementary and not alternative. As a result, the Metropolitan-Vickers Electrical Co., Ltd., was placing on the market a grass dryer suitable for farm use, manufactured on principles worked out by I.C.I. The company had taken part in the formation and work of the Council for Research on Housing Construction, which took its rise from joint investigations with the British Steelwork Association.

New Products on the Market

Many new products, or marked developments of existing lines, were placed on the market during the year. A number flowed from organic research and were spread over a wide range of rubber chemicals, textile and leather assistants, foundry chemicals and pesticide products. Several sections of the dyestuffs field still presented a striking picture of activity with regard to new products. A non-inflammable high-melting synthetic material, sold under the trade name of Seekay Wax, was finding many uses for which its admirable and diverse properties make it suitable. Arising from our hydrogenation technique, useful solvents were now being manufactured. Sodium aluminate for water softening was being made in considerable quantity. Engineering research had resulted in the development on a commercial scale of an ammonia cracker and an ammonia burner which were already promoting the sale of ammonia as a source of industrial gases. Other engineering inventions of more general application had been disposed of to the manufacturers of plant best equipped to develop them. Numerous additions have been made to the range of synthetic resin bases for finishes of many kinds. A "Dulux" white enamel was now on the market and was already a successful seller. The manufacture of landing flares suitable for aircraft was a recent development.

Research activities in the laboratories had included the investigation of a range of copper alloys which had the remarkable property of hardening considerably under heat treatment. He believed these "Kunial" alloys would prove to be of importance in extending the field of application for non-ferrous metals. In spite of the acceleration in new developments, there was no lack of scope for further work in this direction.

Fig. 1.—Efficient Laboratory Planning as exemplified at the University College of North Wales, Bangor.
(Alan E. Munby, M.A., F.R.I.B.A., Architect.)

Modern Research Laboratories

How They Should be Planned and Fitted

By ALAN E. MUNBY, M.A., F.R.I.B.A.

IT is hardly more than a generation since research and industry were comparative strangers, the man of science working alone in his laboratory and the industrialist, content with rule of thumb methods, regarding him with indifference as a theorist. Works laboratories which existed were mostly confined to routine testing, research being regarded as a matter quite outside any trade necessities while those trained in the field of pure science would express surprise were it suggested that their work might be turned into directly utilitarian channels. Occasionally, more often than not accidentally, some discovery in pure science found a striking industrial application conferring immense benefits on humanity, but the resulting flood of light to be expected on the immense possibilities obtainable from close co-operation remained absent, and humanity accepted the benefits without any particular acknowledgment, whilst industry and science retired into their respective spheres

In the days of Britain's industrial supremacy this detached attitude, though unfortunate from the standpoint of progress, did not matter very much economically. With the world's markets at command, national indifference to science and scientific method could be tolerated, but conditions have altered. Others have been applying science to trade and attention to this subject has been brought home to us, not apparently with any great change of heart, but as a matter of necessity. Trade, once almost automatic, is now secured only by very fine margins which often depend on the ability to apply some discovery in pure science (which in itself may appear almost trivial) to industry. For example, a fractional percentage of some foreign element may so profoundly alter the characters of a common metal as to give it entirely new or specialised uses. Research alone can lead to such discoveries, while industry alone can make their application possible. A market is only held by progressive methods, hence the advent of the research laboratory into industrial works.

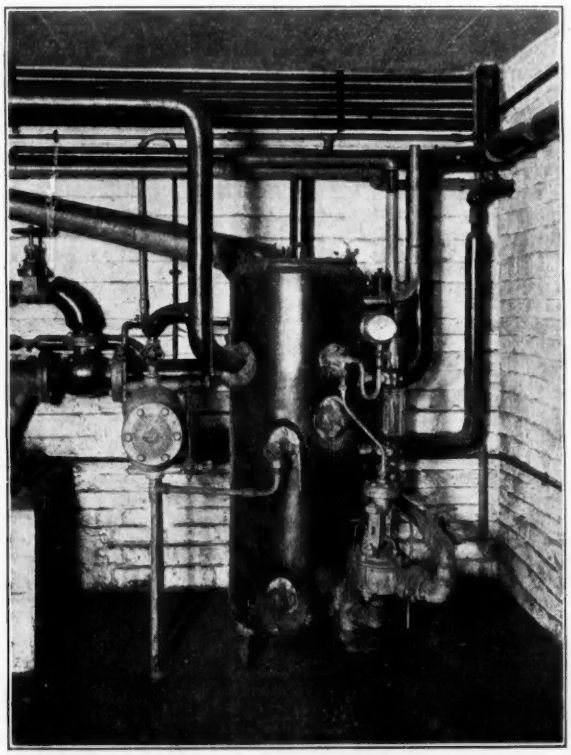


Fig. 2.—Bench Steam Supply Plant, Science Building, Clifton College.

A works laboratory will naturally depend largely for its character on the research subjects and the scale of operations, but there are broad principles which apply to any works scheme. Although an old shed tucked away in some corner may quite possibly turn out good work from efficient occupants it will not do so economically, for a laboratory is essentially a building which requires to be properly planned. Where a research laboratory is a new undertaking, it may be agreed that proof of real utility should precede outlay on bricks and mortar, but such attitude wants justification. If

Fig. 3.—Battery Room University College of North Wales, Bangor

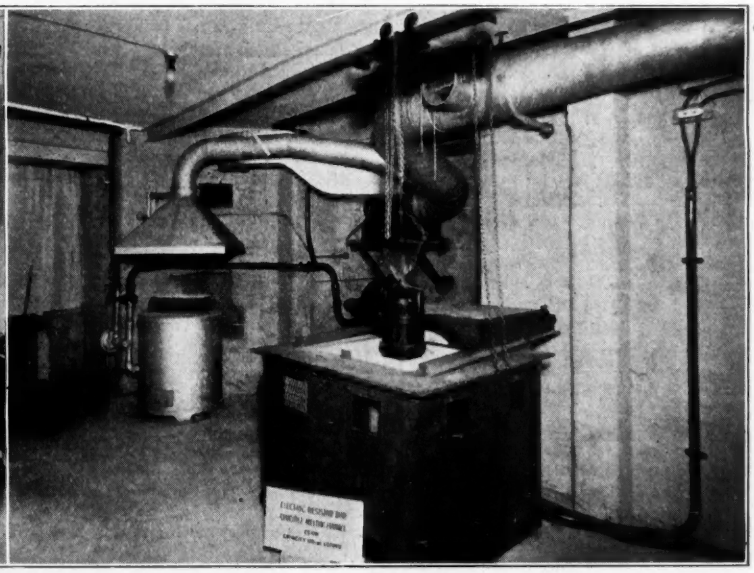


Fig. 4.—Furnace Room, British Non-Ferrous Metals Research Association.

an old, inadequate building is equipped for research it is very unlikely that—once occupied—it will be replaced by anything better for many years, though admitted presently as inefficient. Assuming capital is available at a reasonable rate of interest, initial capital cost should be compared in terms of interest with running costs, when it will be found that the annual cost on capital building charges, even for a scheme of reasonable magnitude, is small compared with staff salaries and running charges for materials and services. An efficient building costs less to run, and the provision of ample service supplies and other facilities obtainable by good planning may save as much as the interest on the capital necessary for its erection.

Turning to the material aspect of the subject, the site for a laboratory will usually not admit of much in the way of alternative, unless a large area and new works are under consideration. The building should be in touch with the administrative offices as well as with the works, and consultations with directors should be easy. Adequate road access should be provided. Where space it not restricted, a one-storey building has some advantages; construction may be simple and the very important problems of drainage and service supplies are made easier. Fig. 1 gives the plan of a one-storey chemical laboratory devoted largely to research, where economy in construction was a first essential. It shows how about 10,000 sq. ft. of floor space can be collected under a single block without recourse to any unusual amount of roof lighting or space occupied by corridors. The manner in which this is attained is sufficiently indicated by the accompanying section through the building.

Laboratories for chemistry, metallurgy and engineering, must have obvious fundamental differences, not only in equipment but in matters involving construction and surface finishes. Good lighting, natural and artificial, is most neces-

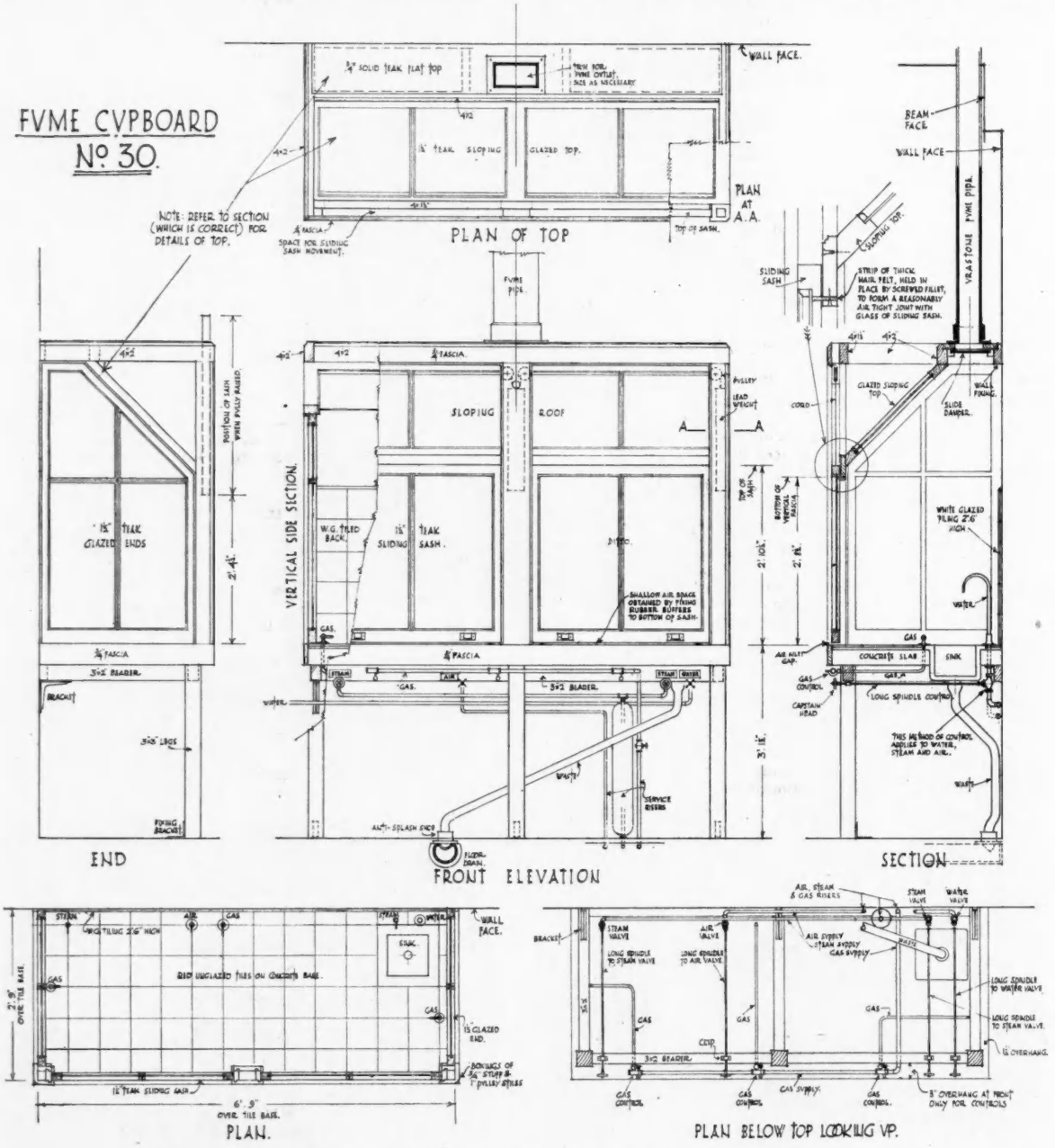


Fig. 5.—Details of Fume Cupboard for Chemical Laboratory. (Alan E. Munby, M.A., F R.I.B.A., Architect.)

sary. Window areas should be ample and top lights, which are very trying where sun can enter, should be carefully planned. Work often involves fine detail and individual artificial lights should be generous and may have to simulate daylight for certain researches.

Heating should exceed that required for a factory, as the comfort of the research worker is essential for his best efforts.

Ventilation has been proved to preciably affect output. For general purposes a simple extract system is sufficient, but special means must be provided for fume cupboards and hoods over furnaces and stills. Fig. 5 shows a working drawing for the construction of a modern fume cupboard, and indicates the amount of detail necessary in the construction of fixed fittings for an efficient laboratory.

Floor surfaces are important, both as regards durability and the comfort of the worker. Cement, though in its harder forms suitable for stores and some shops, is tiring and readily attacked by acids; many patent flooring surfaces are unsatisfactory; but wood blocks or narrow boards (preferably of teak) have a wide general utility, apart from exceptionally heavy wear. Linoleum is suitable in certain rooms not liable to spilt alkalis. Asphalte should be used for places like battery rooms, illustrated in Fig. 3.

Drainage is a subject which frequently gives rise to difficulties, and there is probably no material but acid resisting vitreous glazed ware that will stand all laboratory effluents. The writer has used or experimented with wood, pitch, cast iron, vulcanite, nickel alloys and asbestos treated with P84 silicate of soda, with a view to obtaining reduction in the many joints necessary in glazed ware drains. Some of these alternatives are suitable under defined conditions of service. Large volume of water and much hot water often require special consideration in arranging a drainage system.

Ample service supplies are essential in any laboratory scheme, as addition after the building is equipped is usually difficult. These should comprise cold and hot water, gas, steam, vacuum, compressed air, A.C. and D.C. electricity. Chemical science makes the greatest demands, though certain physical researches may require very heavy and specialised electrical services. Fig. 2 shows a very small gas-heated automatic steam plant for experimental work in a laboratory, and Fig. 4 shows certain furnaces in a metallurgical laboratory calling for heavy currents, gas supply, and special ventilating arrangements.

Service mains should be made accessible by the provision of underground trenches, ducts over false ceilings in corridors, or vertical shafts in walls and should be grouped or distinguished by coloured paints. In a large building, ring mains to admit of equality of distribution may be desirable. The provision of stop cocks to all mains and branches of service pipes will greatly facilitate repairs without undue curtailment of supplies.

The location of running plant may require consideration to avoid noise and vibration in the laboratories, rotary plant being less troublesome than reciprocating plant.

This very brief outline of research laboratory requirements is perhaps sufficient to show that the subject is one deserving careful thought and debate before anything is embarked upon, and that time spent in transmitting the exact requirements to the architect or engineer responsible for their execution to enable these requirements to be embodies in a set of plans and detailed drawings, will not only be time eventually saved but will be likely to lead to a satisfactory result as including all that the research staff really needs. At the same time it will avoid the annoyance and expense of alterations, by no means infrequent in laboratories very soon after they are opened.

It is reported in Amsterdam that a trial order for Russian potash was placed recently by a Netherlands firm, and that a shipment of 450 metric tons of Russian potash was recently dispatched to Japan via Amsterdam. It was stated in Netherlands papers that the Solikamsk mines produced 120,000 tons of salts in 1931 and were scheduled to produce 800,000 tons in 1933. A capital investment of 45 million rubles was made in these potash works in 1933, and further investments of 68 millions and 42 millions respectively have been budgeted for the two succeeding years. These investments are expected to suffice for completion of the initial installations.

Lawn Tennis Tournament

Entries Close Next Wednesday

To meet the convenience of a number of players who, owing to the recent bad weather, have not yet opened their 1934 season, the closing time for The Chemical Age Lawn Tennis Tournament has been extended to 9.30 a.m. on Wednesday morning next, May 2. The Tournament, comprising singles and doubles, is open to all men engaged in the chemical profession or industry, without entrance fee, and is played in accordance with the Rules of Lawn Tennis and the Regulations of the Lawn Tennis Association. The Chemical Age silver challenge cups are held jointly by the winners and their firms for twelve months, and smaller trophies are presented outright to the winners and runners-up.

Entry forms (and copies of the rules if desired) are obtainable on application, either personally, by post or by telephone (City 0244) to The Editor, The Chemical Age, Bouverie House, 154 Fleet Street, London, E.C.4, or if time does not permit, entries may be submitted on ordinary notepaper, giving the names of competitors, their firms, addresses, telephone numbers, and an indication as to whether the entries are for singles or doubles. Full particulars of the Tournament appeared in The Chemical Age last week (p. 336).

Spontaneous Ignition of Jute

Effect of Contamination with Oils

Fires in jute cargoes destined for American ports have recently prompted the United States Bureau of Standards to determine the susceptibility of jute to spontaneous heating from microbial growths, and from vegetable and animal oils spread over the jute. Tests were conducted with samples ranging in size from a few grams to the 400 lb. bale in which the jute fibre is imported.

In the general method of testing adopted, the temperature of the air in the chamber surrounding the sample was maintained a little below that of the sample, after self-heating had begun. The sample was, in effect, thermally insulated, thus approximating the condition which exists for any given portion of the material contained within a larger mass. No temperatures above 59° C. were obtained due to microbial action, which indicates that no consequential probability exists that ignition can occur from this cause. Only slight heating occurred where the moisture content was initially no higher than 30 per cent. of the weight of the dry jute. Moderate heating, however, developed with initial moisture contents of over 50 per cent., and additions of cultures of micro-organisms appeared to accentuate the heating slightly, although for this condition also it was limited by the moisture content.

Self-heating resulting in ignition was obtained consistently with linseed oil and menhaden oil spread on jute and on cotton fibre, starting with initial temperatures in the range 36° to 50° C. With a drying oil added to linseed oil of amount comparable with that present in prepared paints, ignitions were obtained with initial temperatures no higher than 30° C. No significant difference was noted between jute and cotton fibre in their susceptibility to spontaneous heating with the given oils. The oxidation is primarily of the unsaturated compounds in the oil, the fibre serving to give a large exposed area for the oil film and as material in which ignition can occur after a sufficiently high temperature has been reached.

As a result of methods developed in this work it is now possible, for the first time, to obtain ignitions in almost all trials without the addition of special accelerating agents to the oils. It was found that the factors favouring heating and ignition include optimum percentages of oil to fibre and thorough coating of the fibres with the oil. The density and size of the sample were also found important, as well as the surrounding temperature and air supply. The tests were conducted in co-operation with the Bureau of Chemistry and Soils of the Department of Agriculture and the Loss Prevention Committee of the Marine Underwriters. A more detailed account of the work is given in Part II of the quarterly bulletin of the National Fire Protection Association, January, 1934.

The Determination of Calorific Value

A Modern Bomb Calorimeter for the Fuel Laboratory

This article, which has been specially written for THE CHEMICAL AGE by a member of the technical staff of Griffin and Tatlock, Ltd., gives particular attention to the Griffin-Sutton Bomb Calorimeter in which many novel features have been incorporated.

DETERMINATIONS of calorific value are mainly carried out by means of a bomb calorimeter. Bomb calorimetry may be defined as that branch of physics which deals with the measurement of calorific value of solids, liquids or gases, by complete combustion in an excess of oxygen and observation of the ensuing rise of temperature. There are two main classes of apparatus—(a) constant pressure calorimeters, (b) constant volume calorimeters.

Constant pressure calorimeters were probably first employed by Rumford, in 1814. His apparatus consisted of a large copper container, several litres in capacity, heated by an interior tube through which the products of combustion passed. The substance was burned at a small burner placed under the boiler and the air used for the combustion circulated round the heater before passing to the burner, thus preventing loss of heat by radiation. Rumford was the first to introduce the method of calorimetric correction by arranging the initial temperature to be as much below the temperature of the room as it was judged that the final temperature would be above that of the room. Dulong, in 1838, employed oxygen for the combustion and obtained results of correspondingly increased accuracy. The values that he obtained for hydrogen and for CO_2 are but little different from those now accepted.

Favre and Silvermann, in 1852, made some attempt to improve the design of the apparatus employed in these determinations by placing the combustion vessel in an internally silvered calorimeter. The combustion vessel itself was of about 2 litres capacity and is interesting in that provision was made for viewing the substance during the progress of combustion. A tube, closed by a composite plug of quartz, alum and glass, so constructed because of its diathermanency, was fixed to the top of the combustion vessel and a mirror placed at the top of the tube, at an angle of 45°, permitted observation of the burning substance. Other designs of calorimeter, notably those of Alexejew, Fischer, Thomsen, Carpenter and Schwackhofer made their appearance subsequently, but did not arouse any permanent interest and it was not until it came generally to be realised that determinations of the calorific value of coal were of definite commercial value and the development of the Lewis Thompson calorimeter that constant volume calorimeters came into general use.

One of the accompanying illustrations (Fig. 1) shows a complete portable outfit, for the determination of the calorific value of coal, such as was formerly in common use. The powdered fuel is incorporated with an oxidising mixture consisting of 3 parts of $KClO_3$ and 1 part of KNO_3, the fuel-oxidiser ratio being 1 : 11-14. This mixture is placed in a copper tube called a " furnace " which may be either short or long. The short furnace is used for difficultly combustible fuels, e.g., anthracite, and the long furnace for easily combustible fuels. This furnace is then placed in the three springs attached to a perforated base and fired by means of a short length of fuse. A copper tube with tap is then placed over the furnace and, engaging with the outside of the springs on the base, enables the whole to be lifted and rapidly transferred to the water vessel previously filled up to either the 1,934 cc. or 2,000 cc. mark. These alternative graduations enable easy calculation of the calorific value in either B.Th.U. per lb. or calories per gram.

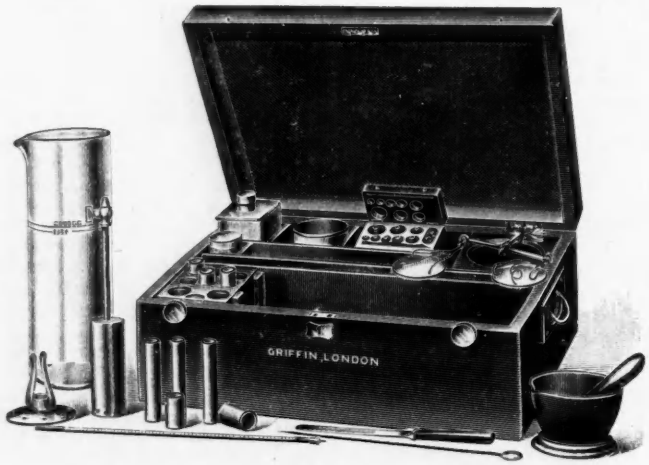


Fig. 1.—The Lewis Thompson Calorimeter : Portable Outfit.

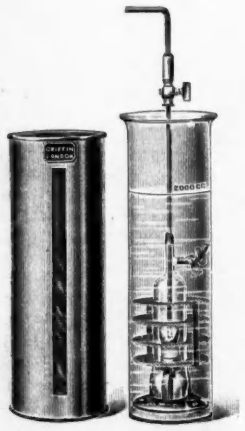


Fig. 2.—The William Thomson Calorimeter.

When combustion is completed, the tap of the copper tube is opened to admit water to the combustion chamber and the whole is then used to agitate the water in the vessel, the rise of temperature of which is then read and the calorific value calculated. The results obtained with this calorimeter are of questionable absolute accuracy, but it may be considered serviceable in those cases where quick comparative results are required.

The William Thomson Calorimeter

The William Thomson calorimeter (Fig. 2) was described in " Journ. Soc. Chem. Ind.," 1886, and differs from the Lewis Thompson mainly in that, instead of a chemical oxidiser being employed, oxygen gas is passed into the calorimeter during the process of combustion. The fuel is weighed into a clay crucible which is placed in springs on a metal base and fired by means of a fuse. The glass combustion chamber is pressed home over the crucible and the whole is rapidly lowered into the water contained in the glass jar, a copper thermal shield for which is provided, having a strip window through which the contents can be observed. Oxygen is then admitted via the tap at the top and as combustion proceeds, the connecting tube is gradually pushed down until it is finally just above the glowing coke. A series of gauze baffles is fitted which acts as a thermal scrubber for the hot gas

which emerges from the combustion chamber. When combustion is completed, water is admitted to the combustion chamber, stirring is effected and the calorific value calculated in the usual manner.

Thomson's own comments on the calorimeter are that "it is not intended for scientific researches, but for handy use of mechanics or for popular use."

Constant Volume Calorimeters

The bomb calorimeter, used so extensively at the present time, is of the constant volume type, in which, in contradistinction to the constant pressure type already discussed, combustion is carried out in a closed vessel at a relatively high pressure, usually of the order of 25-30 atmospheres and, combustion being practically complete, good and concordant results may be obtained. Purchasers of coal, particularly,

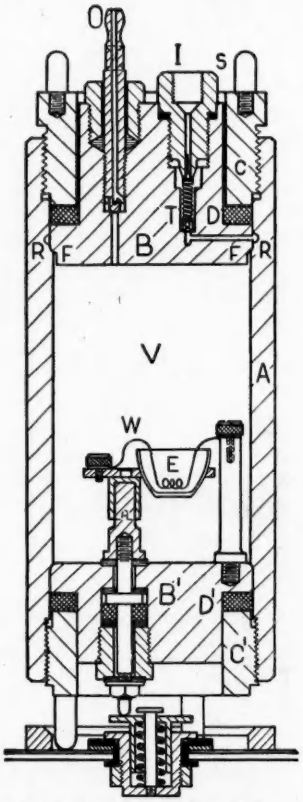


Fig. 3.—The Griffin-Sutton Bomb Calorimeter: Section showing Construction of Bomb.

adopt this method of heat evaluation and the technique of combustion calorimetry has now been so well developed that a skilled operator can average thirty-five determinations per day.

Andrews, in 1848, was probably the first to publish results obtained with a closed calorimeter, although he confined his attentions mainly to the heats of combustion of gases. The apparatus consisted of a copper cylinder about 380 cc. capacity and weighing about 170 grams into which the gas, admixed with oxygen was introduced. The hole at the top was then closed with a stopper through which passed a platinum wire for igniting the gases. This combustion chamber was immersed in a glass cylinder of water and Rumford's method of compensation was adopted. Combustion usually lasted about 35 secs., a rotary motion being imparted to the calorimeter meanwhile. Later, Andrews applied the calorimeter to combustion of solids, but, although he obtained fairly reliable values for gases, those for solids were low, due, probably, to incomplete combustion.

Berthelot, however, is regarded as the originator of the modern bomb calorimeter, although he, like Andrews, used it first for gases only, and subsequently, in collaboration with Vielle, adapted it for use with liquids and solids. The body of the bomb was of steel, constructed to withstand a pressure of 250 to 300 atmospheres and fitted with a screwed steel cover. This cover carried a screw-down inlet valve by which the flow of oxygen into the interior of the bomb was regulated, and an insulated platinum rod which projected into the bomb and formed one of the crucible supports. The other crucible support was screwed into the cover of the calorimeter which formed the second pole for the electrical ignition system. A piece of fine platinum wire connected across the supports, dipped into the substance in the crucible and, being raised to incondescence by the passage of the current, fired the material, which then burned completely in the oxygen. A thermometer of the Beckmann type was used to measure the rise of temperature of the water in which the bomb was immersed. Some of the results which Berthelot obtained for

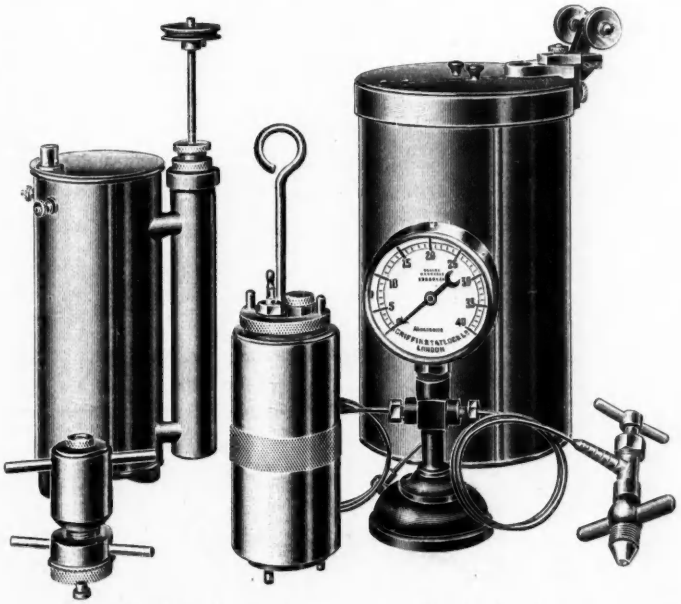


Fig. 4.—The Griffin-Sutton Bomb Calorimeter: the Complete Equipment.

calorific values are surprisingly good and are not very different for those accepted at the present day.

The evident success of Berthelot's method stimulated other workers to endeavour to eradicate the faults in his bomb and in consequence there emerged at different periods, the Mahler, Kroeker, Mahler-Kroeker, Walther-Hempel and other bombs.

The Griffin-Sutton Bomb Calorimeter

One of the most modern types is the Griffin-Sutton bomb (Fig. 3), which claims to attain an accuracy of 0.1 per cent. on the calorific value and 0.05 and 0.01 per cent. respectively on the carbon and sulphur contents. The body A, of the bomb, is a stainless steel tube machined from the solid metal. It is screwed internally for a short distance at both ends, where, in addition, small shoulders are formed. The lower end is sealed by a rubber washer D^1, inserted between a flanged cap B^1 and a screwed sleeve C^1. The cap B^1 carries the ignition pillars and crucible support, which, being short, are rigid and strong. The pillar carrying the crucible support is insulated from the cap B^1 by a bush and by mica washers and makes contact with a spring fixed to the bottom of the calorimeter as shown in illustration.

The upper end is sealed in a similar manner by a washer, cap and sleeve D, B and C respectively. The upper cap carries a screwed and riffled tube O, which is held in a gland and used for carrying off the gaseous products of combustion. This exit is sealed, while a determination is in progress, by screwing O down on to a seating in the cap by means of a small key. The inlet valve T is of the Schrader type and is easily replaceable. Connection is made to the

oxygen cylinder at the screwed inlet I, the path of the gas being through the valve T, and along a horizontal duct into the annular groove RR turned in the wall of the bomb. From here, the gas enters the interior V of the bomb, in a cylindrical stream down the sides of the vessel via the space FF, thus avoiding any risk of disturbance of the charge in the crucible E.

The caps B and B^1 are free to move axially in the sleeves C and C^1. By reason of the internal shoulders on the wall of the bomb they cannot move inwards, but the pressure of the gas on these caps forces them outwards in opposite directions, compressing the washers D and D^1 and thereby completing the sealing.

Five Important Advantages

The main advantages arising from this method of construction are given in number. In the first place, sealing by internal pressure which enables the ends to be screwed in lightly by the fingers and as easily removed after the pressure has been released. Secondly, there is even distribution of the incoming oxygen round the internal wall of the bomb, thus completely avoiding disturbance of the charge. Thirdly, there is an unusually large area of contact between outer wall of bomb and surrounding water, owing to long length and small diameter of the bomb. Low water equivalent and high temperature rise comprise the fourth advantage. Lastly, the bomb has a clean straight cylindrical shape, ensuring against water pockets and making the interior easily accessible for cleaning.

The complete Griffin-Sutton bomb calorimeter equipment is shown in Fig. 4. It comprises the bomb (centre), calorimeter vessel (left hand), thermal shield (right hand), charging-pressure gauge (front right), and pellet press (front left). The actual calorimeter consists of two cylindrical vessels of different diameters, joined by short tubes near the top and bottom. In the small tube a propeller stirring device is located, running on ball bearing journals. The bomb is placed in the longer tube and is positioned by the annular ring on the base of the calorimeter (see Fig. 3), which also completes the ignition circuit when the two terminals on the calorimeter are connected to the external source of current.

The pellet press (Fig. 5) is of novel design and is of considerable utility where large numbers of determinations are carried out. It enables the ignition wire to be moulded into the body of the pellet and thus reduces ignition failures to a minimum. In some cases, particularly where moisture determinations have been carried out on the sample, difficulty may be experienced in obtaining a coherent pellet. In such cases, the material may be damped with a few drops of a 1 per cent. solution of gum arabic. The pellet press plunger runs on ball bearings and the method of operation is to place the powdered material into the hole in B and to screw down A until the desired degree of compression has been attained; C is then unscrewed and on screwing A down further, the compressed pellet is ejected by the descending plunger. To mould the ignition wire into the pellet the wire is threaded through two holes in the plug which closes the hole in B, bringing the free ends out through the hole C. The remainder of the operation is then as described above.

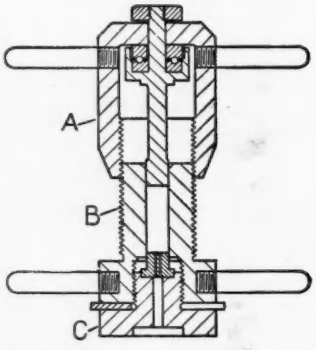


Fig. 5. Pellet Press for Solid Fuel.

Drying Ovens and Related Equipment

A Range of Models with Novel Features

An advance in the construction of water-jacketed drying ovens is featured in the new patent "Sanbro" type manufactured by Brown and Son (Alembic Works), Ltd. In this oven (Fig. 3) the bottom or water chamber is a separate unit, built with a water gutter around its top edge. The upper part containing the drying chamber and surrounding steam space sits in this gutter and a steam tight joint is made by the water seal. The inner edge of the gutter is pitched slightly lower than the outer edge. Thus, water coming down the inner wall of the jacket by air condensa-

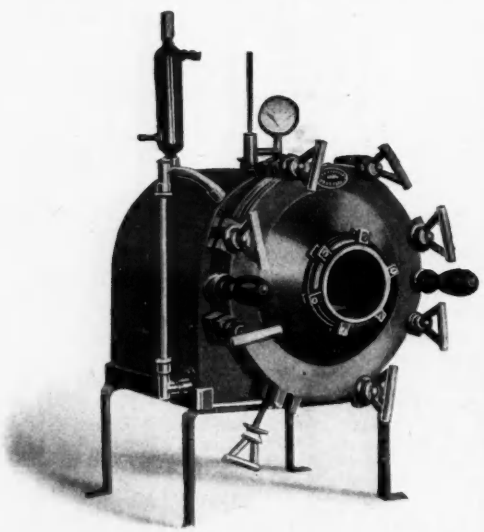


Fig. 1. Vacuum Drying Oven.

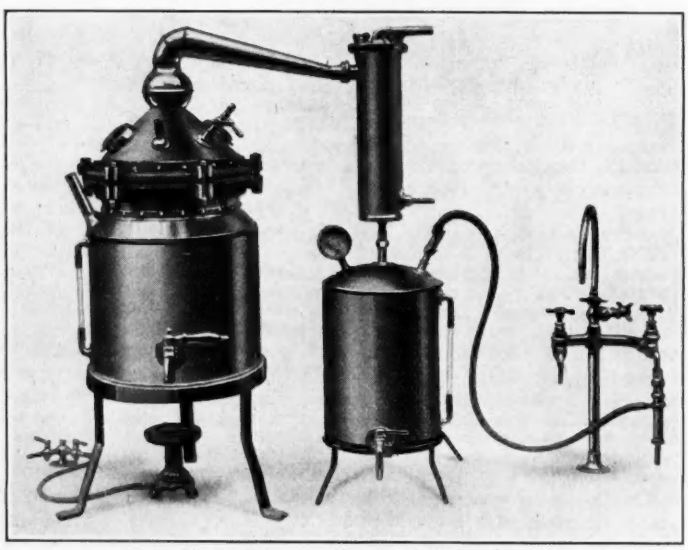


Fig. 2. Laboratory Vacuum Distillation Plant.

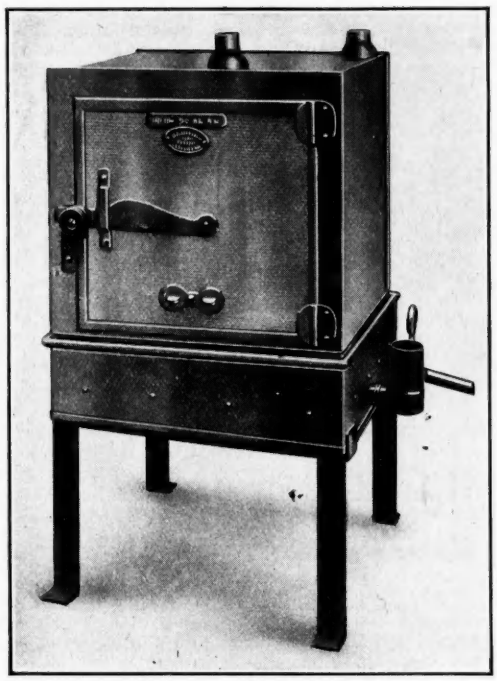


Fig. 3. The "Sanbro" Water-Jacketed Drying Oven.

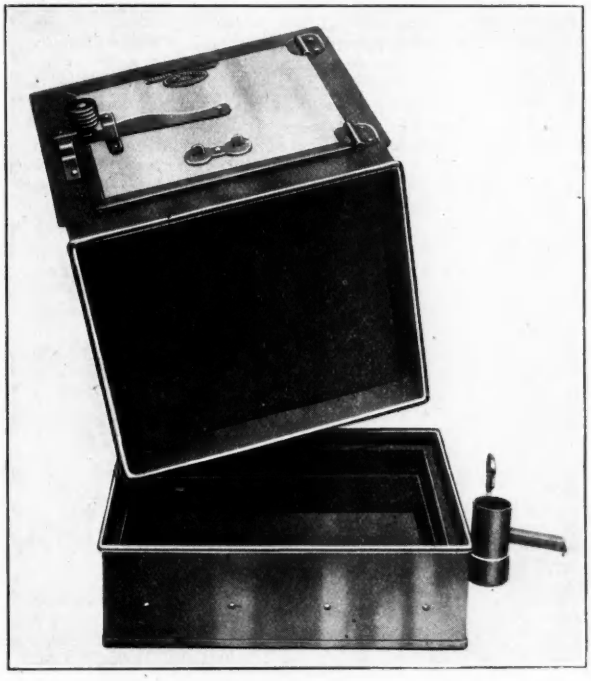


Fig. 4. The "Sanbro" Oven lifted from its base to show Water Seal.

tion overflows into the water chamber and not outside.

There are two main advantages of this type of oven over the old soldered up type. In the first place, the extreme ease with which cleaning and removal of lime can be done is conducive to more frequent and thorough cleaning; thereby the life of the oven is considerably prolonged and gas consumption is less. Secondly, in the event of accidental boiling dry, only a minor and comparatively cheap part of the oven is spoiled, and the upper and more costly section remains unharmed. Fig. 4 shows the oven lifted off its base; the simplicity and ease with which the base can be inspected, cleaned or removed, will be obvious. It is made in all usual sizes, with or without water still.

An improved form of hot air oven is shown in Fig. 6. In this oven a stream of pre-heated air passes into the interior and, by a staggered arrangement of shelves or trays, the air

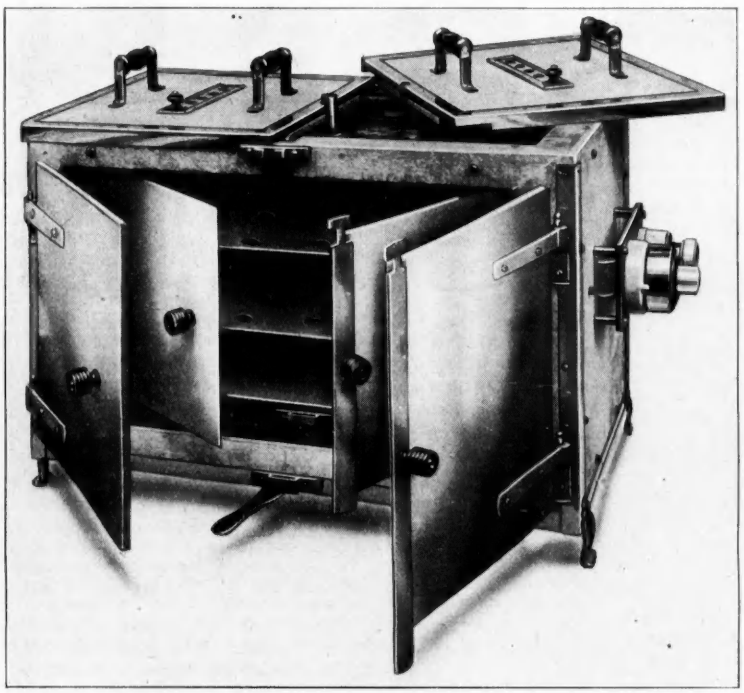


Fig. 5. A New Design in Hot Air Sterilising Ovens.

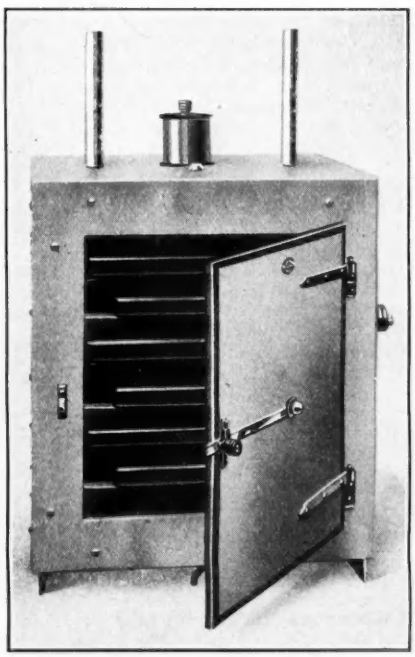


Fig. 6. Hot Air Oven with Staggered Shelves to facilitate contact between Hot Air and Material.

is forced to travel across each before it can escape. An ingoing draught is induced by tall pipes attached to the top of oven. This type is made both gas and electrically heated, and is mainly used for powder, pills, granules, etc. It is manufactured in sizes from 12 inches cube up to 36 inches cube.

The vacuum drying oven, shown in Fig. 1, may be arranged for heating by gas or electricity, with or without water jacket. The interior is cylindrical in shape varying in diameter from 7½ to 30 inches and depths from 10 to 36 inches. The door is a massive gunmetal casting, hinged and rendered airtight by swing clamps and seating on a special composition washer. A glass plate window is fitted both at back and front. With a light suitably arranged to shine into the back window, the whole interior is illuminated and observation is by means of the front window. A vacuum indicating gauge is also fitted. When used for inflammable materials steam heating can be fitted, to obviate risk of fire or explosion.

The new form of hot air sterilising oven (Fig. 5) may be described as an "oven within an oven." It is so built that the top of the outer casing consists of a pair of lids. When the sterilising operation is accomplished, these lids, with their heat-proof handles, may be lifted off and the inner oven taken out to allow contents to rapidly cool off in a perfectly sterile atmosphere. When sterilising at high temperatures (160-180° C.), this avoids a long wait for cooling. These ovens are made in steel, copper, monel metal or stainless steel, in the usual sizes.

A useful experimental plant of laboratory size for vacuum distillations, concentrating, separating, etc., is also made by Brown and Son (Fig. 2). This consists of a water-jacketed still, condenser, and receiver-sump. It is heated by gas, electricity or steam. Observation windows are fitted to the still-head for watching internal reactions and effects. A range of sizes, from ½ to 5 gallons capacity, is made; for moderate vacuum the sizes up to 3 gallons may be successfully worked with a gun-metal filter-pump illustrated in the picture. The whole apparatus is readily dismantled into separate parts to permit cleaning after each operation.

Fire Protection for Chemical Laboratories

Selecting a Reliable Fire Extinguisher

THERE is evidence in the daily newspapers of the increasing danger of fire outbreaks in chemical laboratories. Quite possibly this serious question is overlooked in sublime ignorance of the real possibilities of fire at its worst, and the efficiency of such emergency measures as hand fire extinguishers. The right type of first-aid fire extinguisher—specially designed for a certain class of fire risk—can be applied to the seat of the fire in a matter of seconds and the flames put out in as short a time with little or no damage. On the contrary, if such a fire is given time to spread, the chances of extinction become a vastly greater problem.

Highly-volatile and inflammable liquids demand special protection; water and ordinary extinguishers are worse than useless and, in some cases, increase the area of the fire by spreading the blazing liquids in all directions. Furthermore, water applied in quantities is liable to cause unnecessary damage, apart from that caused by the flames. Such fire risks can be quickly and effectively overcome with the "Pyrene" fire extinguisher, which is specially designed to cope with blazing oils and spirits and electrical outbreaks. It embodies a double-acting, rotating pump and projects a powerful continuous jet of "Pyrene" fire extinguisher liquid, which instantly subdues the flames. This liquid is non-damaging, non-corrosive and is a non-conductor of electricity. The extinguisher can therefore be used on all electrical fires with absolute safety to the operator. The "Pyrene" extinguisher works in any position and does not depend on maintained pressure. It is easily filled up again after use simply by pouring in a sufficient quantity of the fire extinguisher liquid. The extinguisher, moreover, is made in junior and standard sizes, in several attractive finishes. Where larger fire risks of this nature are involved, one and two gallon sizes are available.

In addition to the presence of highly inflammable liquids and substances, there is always the danger of the flames spreading to woodwork, cloth, paper, upholstery or other freely burning materials. The most efficient method of coping with this class of fire risk is provided by the soda-acid type of hand fire extinguisher. The "Conquest" extinguisher—anothor ef the "Pyrene" range of appliances—is a highly efficient safeguard, designed for coping with general outbreaks. It projects a powerful jet of fire-killing liquid and is made in several different models of two gallons capacity. Operation is easily effected either by turning the extinguisher upside down or by striking the plunger, according to the model selected.

Where quantities of oil, spirit or other inflammable liquids are used or stored, it is advisable to install the "Phomene" foam-type fire extinguisher. This extinguisher is made in several different models of one and two gallons capacity and produces many times its own capacity of fire-killing foam, which spreads over the surface of the blazing liquids and completely blankets the flames. The "Phomene" 10 and 34 gallon foam engines, foam generators and foam installations are also supplied in a range of capacities to cover such fire risks of still greater proportions.

The wide range of fire appliances manufactured by The Pyrene Co., Ltd., also comprises CO_2 hand extinguishers and

Three Typical Hand-Operated Fire Extinguishers.

complete CO_2 installations, automatic fire units using "Pyrene" fire extinguisher liquid, CO_2 gas or "Phomene" foam, hose, hose reels, hose cradles and hydrant valves, etc. The company offers the impartial advice of their expert fire engineers who will report on existing fire risks and recommend the most suitable protection without any obligation.

NOW that scientific methods are more generally adopted in the rubber industry, a well equipped laboratory for experimental testing and research purposes is necessary. An article on this subject has been unavoidably held over from this issue of THE CHEMICAL AGE, due to lack of space, but it will be published next week. This article will deal with experimental rubber vulcanising plant, temperature and humidity control tests for ageing, and special apparatus for determining abrasion, flexing, plasticity, grit, etc.

Modern Refrigeration Practice

An Exhibition at the Science Museum

SIXTY years ago mechanical refrigeration was just coming into existence and yet to-day it is an essential part of everyday life, not only in its well-known application of the transport and storage (including domestic storage) of perishable foodstuffs, but in many of the industries upon which this country depends. Of its lesser known uses mention may be made of the manufacture of bread, biscuits, chocolate, margarine, artificial silk stockings and cinematograph films, the brewing of beer, the curing of bacon, the refining of oil and the sinking of mine shafts and wells. These are a few of about 300 industries in which its use is either essential or in which it improves the quality of the product.

With the object of illustrating the part played by refrigeration, and of showing the public the principles on which the several types of machines operate, a special exhibition was opened at the Science Museum, South Kensington, on April 21. An exhibition of this nature has never before been held in Great Britain nor, so far as is known, in any other country. It consists mainly of models, working exhibits and demonstrations, designed and displayed in such a way that some portion of the exhibition cannot fail to interest all visitors, whether technical or non-technical.

The exhibition, which will remain open until the end of August, is the outcome of a suggestion of the late Sir William Hardy, F.R.S., who, but for his untimely death, would have presided this year at the meeting of the British Association. The exhibits have been supplied by the manufacturers and users of refrigerating machinery and the Museum has had the wholehearted co-operation of the British Association of Refrigeration, the National Physical Laboratory and the Low Temperature Research Station.

"Heavy Water"

I.C.I. to Undertake Commercial Production

THE so-called "heavy water" is to be produced commercially in England. This is the significance of a recent announcement by Imperial Chemical Industries, Ltd., that, as a result of research at Billingham, the recently discovered isotope of hydrogen is now to be made available to purchasers in the form of its oxide, "heavy water." Plant has been developed at Billingham capable of producing a continuous supply of "heavy water" of approximately 30 per cent. purity at the rate of 5 gms. per day, while approximately pure "heavy water" will be produced at a somewhat later date.

Large-scale production of "heavy water" is only possible where exceptional resources of power and raw materials exist together. At Billingham, not only ordinary hydrogen in large quantities, but also residues in which "heavy water" has accumulated, are readily available. These resources, together with cheap power and convenient research facilities, establish Billingham as the logical centre for the large-scale production of the new compound. Since its discovery in America, its probable uses are becoming more evident, and it is eloquent testimony to the vitality of British chemical technique that in so short a space of time it should have been translated from a scientific curiosity to a marketable commodity.

Although "heavy water" occurs in all ordinary water to the extent of only 1 to 6,000, yet, because of the enormous quantities of water present on the earth, it cannot be regarded as a rarity. Because of its higher boiling-point (103° C.), it is selectively retained on evaporation of ordinary water, and terrestrial sources vary in their content of "heavy water." Rain water will obviously be weakest in it, ordinary river and lake water contains 1 part in 6,500, sea water 1 part in 5,000, while certain electrolytic residue have been found to contain as much as 1 part in 2,700. All these facts will be utilised in large-scale production, in which preliminary concentration is desirable, but the ultimate method to be used in isolating the isotope at Billingham will be an electrolytic one.

I. G. Farbenindustrie

Manufacturing Activities of Past Financial Year

ACCORDING to the annual report of the I. G. Farbenindustrie, in general the business of the combine was maintained on the internal market but the existing difficulties operated against any expansion in overseas and European markets.

Research work in the dyestuffs field led to the introduction of several notable innovations, including colours in the Fast Alizarin, Sirius and Naphthol AS series.

In the pharmaceutical and insecticide department (Bayer), brisk trading conditions prevailed except on the export side and continued currency difficulties are likely to cause still further deterioration of the export position in the future. Among the conspicuous medicinal achievements of the year were Icoral (for urgent treatment of respiratory diseases); Corbasil (adrenaline-like properties without the latter's after-effects); Bioferrin (a haemoglobin-iron-liver-preparation); Rivoren (iodine-arsenic stimulant); Novocaine-Corbasil (dental anaesthetic). Turnover also increased in sera, veterinary products and insecticides.

The volume of home sales likewise increased in the perfumery branch, but was offset to some extent by reduced prices. Business was maintained at about the previous year's level in other European countries but declined overseas.

Rather more activity prevailed in the home fertiliser market, but almost solely in the lime section. Foreign fertiliser sales did not quite reach last year's level, the most serious decline occurring in ammonium sulphate during the second half-year. Price concessions enabled synthetic nitrate fertilisers to compete with Chilean products. The existing agreement with other European producers was extended for another year as from July 1, 1933.

Rayon sales improved quantitatively (but at the cost of severe price reductions) in the viscose, vistra and acetate sections.

Considerable space is devoted in the report to the topic of hydrogenated liquid fuel and lubricating oils. Further technical advances were announced in connection with direct catalytic hydrogenation of brown coal, whilst satisfactory progress was registered in the hydrogenation of anthracite and the manufacture and improvement of lubricating oils. Further expansion in the sales of Leuna motor spirit was affected, largely through the filling stations of the Deutsche Gasolin A.G. Central German brown coal is being adopted to an increasing extent as the raw material for hydrogenated motor spirit and will form the main raw material at the new Leuna extension.

A summary of the financial aspect of the report was published in the Continental Chemical Notes Section of THE CHEMICAL AGE, April 21, page 340.

Chemical Patents' Committee

To Translate Research into Practice

A CHEMICAL Patents' Committee of the Department of Scientific and Industrial Research has been appointed to advise on the patenting and exploitation of results of the Department's chemical researches that may have industrial possibilities. The committee is the result of negotiations that have been taking place for some time between the Department and various industrial organisations with the object of promoting closer co-operation and of avoiding unnecessary overlapping. It is hoped that one result of the committee's advice will be that research results may be brought to the notice of industry and translated into practice at an earlier stage than hitherto, and under conditions that will take existing industrial activities into account.

Sir Frank Smith, Secretary of the Department of Scientific and Industrial Research, will act as chairman, and in addition to departmental members, the committee will include Dr. F. H. Carr, and Mr. J. Davidson Pratt, representing the Association of British Chemical Manufacturers, and Mr. J. Arthur Reavell, representing the British Chemical Plant Manufacturers' Association.

A Miscellany of Laboratory Equipment

A New Motor Stirrer

A. Gallenkamp and Co., Ltd.

SEVERAL interesting features are incorporated in a new friction-drive universal motor stirrer recently introduced by A. Gallenkamp and Co., Ltd. Speed control is attained without loss of power, because the motor speed remains constant at all stirrer speeds. The stirrer can be varied from zero to 2,000 r.p.m. There is a special clamp on the motor which permits the stirrer being used at any angle; it can also be attached to any laboratory stand. The flexible shaft attachment is also novel, in that it permits placing the motor out of reach of corrosive fumes. Where desired this stirrer can also be equipped for rotating anodes in electrolytic analysis, a chuck being provided to hold the cathode.

Fume Cupboard Ventilation

Matthews and Yates, Ltd.

DURING the past few years Matthews and Yates, Ltd., have installed a large number of their ventilating plants for extracting fumes from laboratory fume cupboards. Usually the fan is fixed on the top of the cupboards and extracts a large volume of air from the cupboards and discharges it out through the roof; the ducts are kept as short as possible and are usually built in earthenware pipes. These fans have a very heavy cast iron casing and impeller and are protected by a special anti-sulphuric enamel. One of our illustrations shows a belt driven model, but the more usual arrangement is for the fan to be fitted with a direct-coupled electric motor which takes the place of the pulley and bracket.

At a Government factory in Lancashire, an ejector principle has been adopted, each fume cupboard is fitted with an earthenware fume outlet pipe in which is inserted an ejector made of glass, the fan is fixed under the bench and supplies a small volume of clean air at a fairly high pressure to the ejectors; six cupboards are supplied by the one fan which is driven by a direct-coupled electric motor. By this arrangement no corrosive fumes come in contact with the fan.

Temperature Measuring Apparatus

Foster Instrument Co.

THE past year has seen several important additions and improvements to the extensive range of temperature measuring apparatus available for industrial and research purposes, and among these, two electrical instruments by the Foster Instru Co. merit special attention. The first is an indicator having an optically-projected scale, which is of considerable length and capable of being read from a distance with great accuracy. The instrument consists of a moving coil millivoltmeter of the patented " Resilia " vibration and shock-proof design, having mounted on and moving with the coil a minute scale, an image of which is thrown in greatly enlarged form on to a ground glass screen by means of a suitable optical and projection system operated from the electric lighting main. The entire instrument is self-contained, and can be used in conjunction with any of the normal electrical heat-sensitive devices, *i.e.,* thermo-couple, radiation tube or resistance element.

The second instrument is an improvement on an existing recorder, and consists of adjustable contacts whereby a signal in the form of a lamp or bell is operated when the temperature recorded attains a set figure, which can be adjusted at will by the user. This alarm mechanism has been applied to a dial recorder, an instrument having a circular 24-hour chart and also the " Resilia " special movement. This combination thus produces at low price a reliable electrical system for recording and signalling temperatures, and is available in many ranges from $-10°$ up to $+1,300°$ C. by use of the appropriate heat-sensitive elements.

A Ready-for-Use Filter Aid

Johns-Manville Co., Ltd.

THERE is a definite recognised need for a product which will speed up filtration procedure in the laboratory. Paper pulp and asbestos fibre require purification treatment before they can be used for analytical work, while other products, such as specially prepared kaolin, are extremely slow filtering.

Celite analytical filter-aid, supplied by the Johns-Manville Co., Ltd., is unique in that it offers the laboratory chemist a prepared ready-for-use, diatomaceous silica filter-aid, of extreme purity, inertness and best filtration characteristics. A suitable combination of treatment processes has removed organic matter completely and reduced solubility in neutral and acid solutions to a practically negligible degree. Its outstanding value is in removing gummy, gelatinous, flocculent or semi-colloidal precipitates from any suspension not strongly alkaline or containing hydrofluoric acid, while the filtration rate is the most rapid obtainable coincident with brilliant clarity in a wide variety of uses.

Specific uses include determination of the total amount of suspended matter, *e.g.,* sewage effluent, the filtration of culture media, serums and toxins in biological laboratories and the filtration of even the most delicate extracts, pharmaceutical solutions, etc. Even in certain problems not involving filtration the material is of value; a case in point is where it functions as a highly inert, porous mass to expose a large drying surface, as in the moisture determination of non-volatile and non-drying oils, syrups, etc.

All-Glass Buchner Funnels

L. Wenborn

AMONGST apparatus introduced to the analytical, research and manufacturing chemist in the last few years, the " all-glass " Buchner funnel is perhaps the most generally useful and appreciated.

For sixty years porcelain has been accepted as the only material possible for this particular type of filtration funnel. There are, however, obvious disadvantages in the use of porcelain—the principal of which is the impossibility of knowing definitely that the surface below the filter plate is clean. In the second place, the weight of the larger sizes is considerable as it is necessary for the walls to be of sufficient thickness to enable firing and glazing to be accomplished without undue loss by cracking and breakage. Thirdly, the small size of the holes in the filter plate is usually a bar to rapid filtration and they are liable to become choked, particularly if the collected precipitate is being washed to free it from an impurity soluble in a hot solvent.

The " all-glass " Buchner funnel suffers from none of these disadvantages, or at any rate reduces the latter to a minimum. The filter plate consists of a series of concentric slits instead of small holes. The rate of filtration is very much increased on account of the greater area available for filtration. The walls of the filter are of specially toughened glass and will withstand subjection to boiling water. The primary difficulty was annealing the filter plate on to the walls of the filter but this difficulty has been completely overcome. The filters are also readily cleaned; any of the usual cleaning solutions may be employed, except for strong alkali, and absolute cleanliness is assured. Five sizes are at present available.

Accurate Temperature Control

Baily, Grundy and Barrett, Ltd.

THE necessity for some reliable means of accurate temperature control has arisen during the last few years on account of the large development in industrial research in connection with the storage of fruit, meat, and other produce, the nature of the experiments calling for a temperature regulation within $1/10°$ to $1/100°$ C., also in connection with textile research where constant humidity is obtained by the wet and dry bulb method,

or by temperature control of the humidifying spray. For the detection of small temperature changes, the plain mercury column type of thermostat possesses the necessary sensitivity and quick response to temperature fluctuations, and can be calibrated to standard temperatures, the temperature adjustment being effected by applying a permanent magnet to the stem, and moving a small capsule in the bore to which the platinum contact wire is attached. In view, however, of the frequency of make and break at the mercury surface a special type of relay is necessary to ensure that the surface will remain clean after prolonged use.

Research work demands that constant temperature must be maintained with absolute reliability for several months consecutively, and to ensure this the relay must have four characteristics. First, it must take a minimum current through the thermostat and avoid sparking. Secondly, the moving parts must be a minimum and all contacts must be enclosed from the atmosphere. Thirdly, it must operate directly from a.c. mains, at standard voltages and periodicities. Fourthly, it must be suitable for individual working by immediate connection to the mains, or for centralisation at one point in the building.

The thermionic relay manufactured by Baily, Grundy and Barrett, Ltd., has been designed specially for laboratory and industrial work. It consists of a thermionic valve, supplied with filament, grid and anode potentials by means of a small transformer connected to the mains supply, operating a mercury tube switch controlling the heaters or other device by means of the anode current, the anode current being controlled by the thermostat connected in the grid circuit. The current passing in the thermostat does not exceed 10 micro-ampères, and the only contacts are at the mercury surface in the thermostat and the main mercury tube switch, both enclosed from the atmosphere. The running cost is low, the current consumption is approximately 0.4 units per 24 hours, and the life of the valve from one to two years

The relays are constructed in a robust form and can be used for many purposes including the accurate control of temperature of hot rooms, incubators, water temperatures, cold rooms, motors, and also the control of humidity by dry and wet bulb method or by the control of the humidifying spray and outgoing air temperature. Where large power circuits of 100 ampères or more are to be controlled, the thermionic relay may be connected to a solenoid operated contact breaker.

Public Analysts' Equipment

J. W. Towers and Co., Ltd.

TWO improved models of the Hortvet cryoscope, for determining the amount of added water in milk by the freezing point method, have been introduced by J. W. Towers and Co., Ltd. The modifications in these instruments do not affect the test result but are of considerable assistance to the operator in carrying out the test. One model is fitted with a hand-operated stirrer, whilst the other is provided with an electrically-driven combined air-blower and stirring device.

The hand-operated model is fitted with a small hand lever at the left-hand side, which operates a rocking arm at the top of the stand to which the stirring rod is attached. By this means the stirrer can be continuously operated without fatigue. Pulleys and cords are dispensed with as they have been found to be unsatisfactory.

For those laboratories which are without a supply of compressed air, the electrically-operated model will be found most convenient. It is supplied complete with a combined electric blower and stirring apparatus. A low horse-power universal electric motor is directly coupled to a small water-cooled rotary air compressor, both being mounted on a wood baseboard. The air supply is ample to evaporate the either in the freezing vessel rapidly. A valve is provided to regulate the amount of air being blown through the apparatus, thereby controlling the temperature of the outer flask. The motor is also fitted with a reduction gear and pulley which drives the stirrer at approximately 40 strokes per minute. The stirring rod can be readily detached in order that the final strokes may be given by hand if desired. Where a large number of tests have to be made this mechanical stirrer will be found of great assistance.

The apparatus consists of a glass vacuum flask in polished aluminium container, tightly closed by a cork through which are fitted the ether blowing tube, T-tube for filling the vessel, and the metal tube carrying the glass sample tube. The latter is closed by a rubber stopper holding the freezing-point thermometer and through which the stirring rod passes, and a sulphuric acid drying tube is provided for the incoming air, a splash bulb being fitted in the connecting tube to prevent acid entering the vacuum vessel. A vapour disposal tube, filling funnel, dipping tube, rubber hammer for tapping the thermometer, thermometer reading lens and milk scale are also provided. Each apparatus is also supplied with one special freezing-point thermometer reading from $+1^\circ$ to -2° C. in 1/100ths, and one control thermometer for the vacuum flask.

Refinements in Instrument Design

C. F. Casella and Co. Ltd.

SEVERAL new instruments for chemical and physical laboratories have been introduced by C. F. Casella and Co., Ltd., within the last few years. Their Fortin barometer, for instance, with its optical zero-reading arrangement is a marked improvement on the old type and makes the readings much easier and more accurate. This instrument has now been re-designed in other minor details. It is fitted with a small filter B to prevent impurities in the air from tarnishing the surface of the mercury in the cistern; the glass tube is supported in the body of the barometer in such a way that it is quite free from strain; and, in addition, the possibility of some instrumental errors inherent in previous designs has been removed. All this has been done without increasing the price.

Another instrument, calling for attention, is their spectrometer. The main features are said to be the excellent design of the parts in relation to the whole, the rigidity of the fixed parts, the smoothness of movement of the moving parts, and the provision for their precise adjustment. The jaws of the slit are of rustless steel with optically polished edges and faces; they are geometrically mounted and closed by a spring in such a way that they cannot be damaged by closing inadvertently. The slit can be supplied with symmetrical or asymmetrical opening.

The Casella's micrometer water level provides a means of measuring pressures or levels to within one-hundredth of a millimetre of water column and has been used with much success in many operations requiring great exactitude. The rails at the sides of the experimental tanks used for trials of model hulls of vessels, at the National Physical Laboratory and elsewhere, were adjusted with the help of this instrument, and it is often used for levelling shafting in works and for measuring deflections under static load.

Ozone for Bleaching Purposes

Ozonair, Ltd.

AN ozone generator is an essential feature of any well equipped laboratory, especially where research may be carried on. The apparatus manufactured by Ozonair, Ltd., has been designed for this purpose and is based on the experience gained in their own laboratory and testing department during the past 30 years. Two models are made as "standard," and each is best adapted for the purpose for which it will be principally used.

The first model (type 55) is of simple construction; it consists of a small ozone generator enclosed in a bell glass and mounted on a glass-lined tripod provided with stop-cock. It is mainly intended for use as a demonstration apparatus, but all the technical applications of ozone, such as sterilisation of water, bleaching and deodorisation of various substances, preparation of fine chemicals, etc., can be performed on a small scale with this apparatus. The yield of ozone can be obtained at a concentration sufficient to bleach oils, fats, etc., while the energy used will not exceed 25 watts for an alternating current supply.

The second model (Type 71) is a reproduction of the commercial or industrial type of ozone generator, on a small

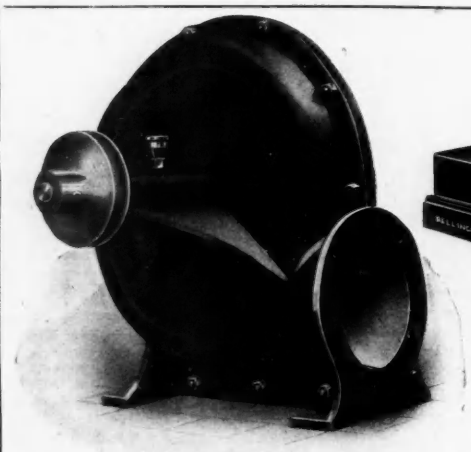
scale. By its use concentrations from air at a strength hitherto unobtainable can be produced. This apparatus is constructed on the well-known Ozonair principle, offering a large cooling surface for the dissipation of the heat incidental to the generation of ozone. It is enclosed in a metal containing tank, which is cooled by water for low concentrations, and preferably by a freezing mixture of ice and salt or other suitable material for the higher concentrations, but under ordinary climatic conditions, say at a temperature under 70° F., the use of the cooling tank is unnecessary except for the highest concentrations. Its capacity at the highest concentration is about 2½ litres of ozonised air per minute, but a much larger volume is available at lower concentrations. The use of oxygen instead of air, or a mixture of the two is, of course, optional.

For the working of either type of apparatus it is necessary to provide a high tension regulating transformer with switch, and in cases where an a.c. supply is not available, a converter will be needed. The equipment, in more important cases, should include a meter for accurately measuring the air volumes, and an aspirator or air pump.

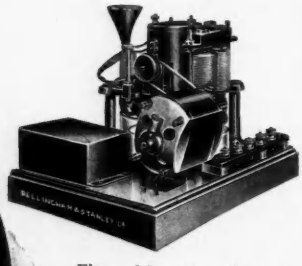
An Electro-Magnetic Separator

Bellingham and Stanley, Ltd.

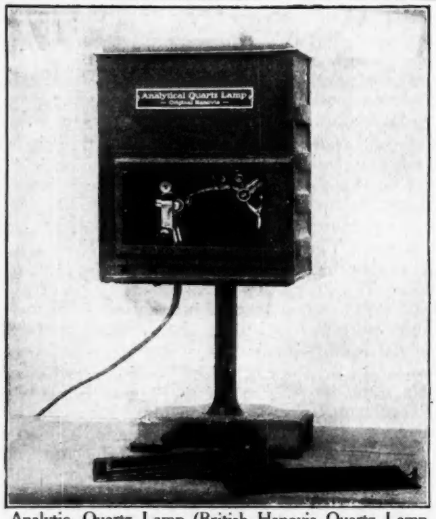
A SIMPLE electro-magnetic separator has been designed by Dr. A. F. Hallimond, F.G.S., for automatically separating weakly magnetic constituents, powdered minerals and sands. This apparatus, which is supplied by Bellingham and Stanley, Ltd., consists primarily of a rotating table, divided into four sections with gaps between, and the material to be examined is contained in a small hopper, the valve of which is arranged to open at the right time. The material on the table then passes beneath the first magnet, which will remove magnetite, etc., and then in succession past two other powerful electro-magnets, the strength and position of which are adjusted to give the necessary separation. When the gaps in the table are reached, the magnets are short-circuited and release the material into the glass dishes placed below. The non-magnetic residue left after passing the three magnets is then swept by a fixed brush into the fourth glass dish. The hopper feed



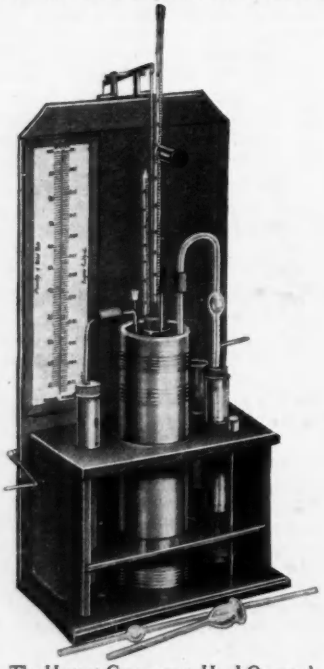
Belt-Driven Fume Cupboard Fan (Matthews & Yates, Ltd.).



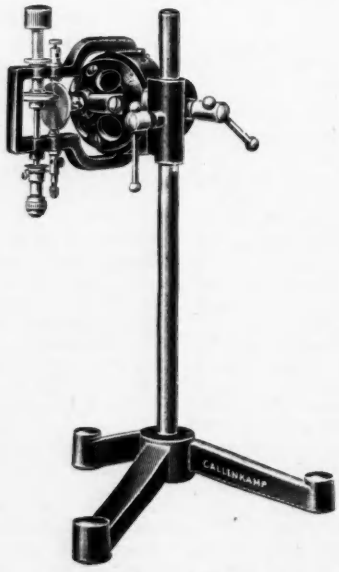
Electro-Magnetic Separator for Mineral Powders (Bellingham & Stanley, Ltd.).



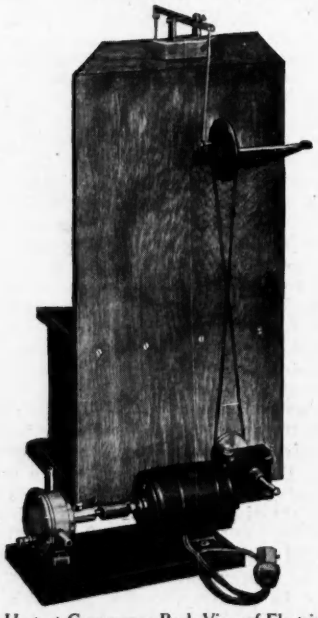
Analytic Quartz Lamp (British Hanovia Quartz Lamp Co., Ltd.).



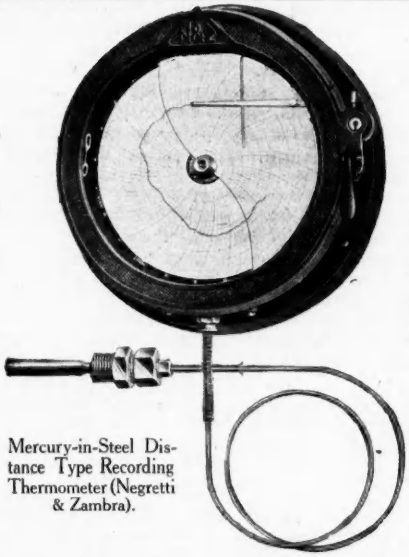
The Hortvet Cyroscope : Hand-Operated Model (J. W. Towers & Co., Ltd.).



Friction Drive Universal Motor Stirrer (A. Gallenkamp & Co., Ltd.).

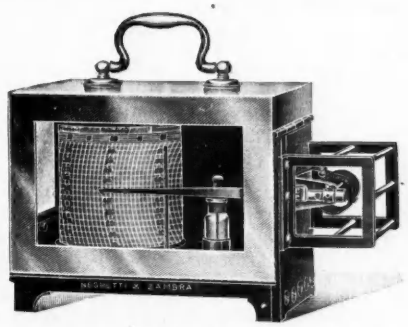


The Hortvet Cyroscope : Back View of Electrically-Operated Model (J. W. Towers & Co., Ltd.).

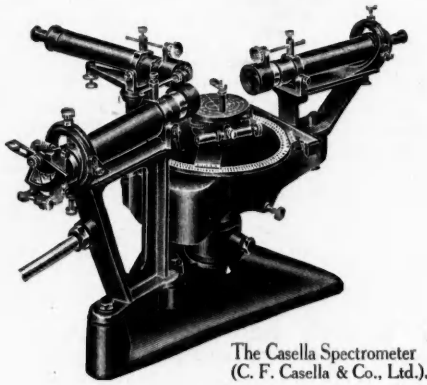


Mercury-in-Steel Distance Type Recording Thermometer (Negretti & Zambra).

Mercury-in-Steel Dial Thermometer, with Rigid Stem. (Negretti & Zambra)

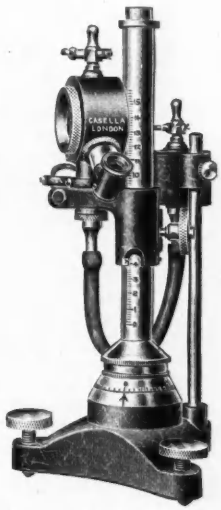


Room Temperature Recorder, operated by Metal Strips having Different Thermal Expansions (Negrett & Zambra).



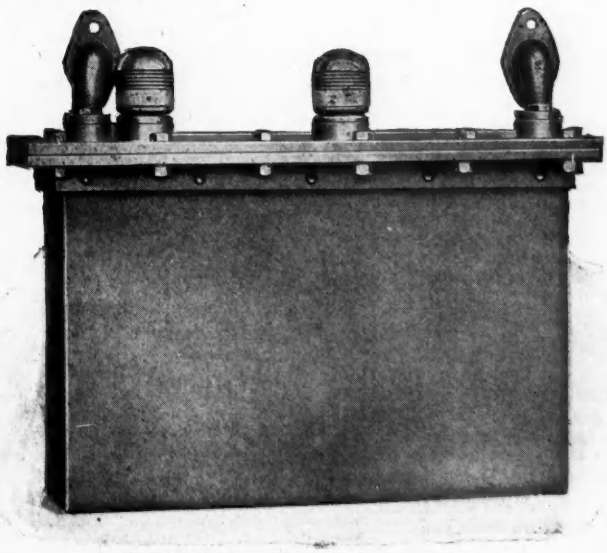
The Casella Spectrometer (C. F. Casella & Co., Ltd.).

The Fortin Barometer (C. F. Casella & Co., Ltd.).



Micrometer Water Level (C. F. Casella & Co., Ltd.).

Ozone Generator, Type 55 (Ozonair, Ltd.).



Ozone Generator, Type 71 (Ozonair, Ltd.).

is adjustable for opening, and the current strength in the electro-magnets and the speed of drive are controlled by means of the rheostat provided.

For research purposes it is essential that the separation should be clean cut; a 90 per cent. separation of glauconite from monazite can be made in a single pass, while the removal of more widely differing minerals is complete. The machine also deals with small samples down to 0.5 gram without loss. This necessitates a small scale and slow feed; the time required for more bulky samples is consequently rather long, but little or no attention is required during operation. Careful attention has been paid to the design of the pole pieces of the electro-magnets, and since a single pole has the serious defect that there is a tendency to form chains of particles which sweep the table, the double pole type has been chosen since the chains are held up between the poles and the carrying power is therefore greater. Since the susceptibility of the minerals is usually of the order of 0.01, the question of short-circuiting the magnetic field by the chains does not arise.

Some Notes on Thermometers

Negretti and Zambra

PRECISION thermometers of the highest accuracy are made with specially selected fine bore capillary tubing and English lead glass, having bulbs of "normal" glass which prevents any secular change due to gradual shrinking, or with boro-silica capillary tubing for ranges over 360° C.

All thermometers for use in the laboratory should be easy to read, and reasonably quick in response to fluctuations in temperature. Where the space above the mercury column is filled with air, the mercury will become oxidised and the bore of the tube will become dirty; for temperatures up to 230° C. it is therefore usual to seal off the tube under a vacuum. If the thermometer is inverted, the thread of mercury becomes easily detached with a slight jolt (unless the bore of the capillary is very fine), but if the thermometer is swung with the bulb down the thread is generally united. In certain cases, however, when the thermometer has been inverted, the mercury will become locked in the top of the tube. This is an inherent defect with all vacuum thermometers with overload cavities, no matter how perfectly made. The error due to this detached mercury might be serious, and such a defect should be looked for; it is usually remedied by a swing of the thermometer.

The boiling point of mercury is 356.9° C. at atmospheric pressure. Above a temperature of 230° C., however, a mercury thermometer must be gas-filled; and with a thermometer used with total immersion, it should be gas-filled for temperatures above 150° C. At a temperature of 500° C. the pressure of gas required is from 15 to 20 atmospheres.

In a precision thermometer, it is advisable that 0° C. or 100° C. should be clearly marked on the thermometer. This forms a check point of great precision when tested in melting ice or in free steam. A precision thermometer, however, should be calibrated with a thermometer immersed to reading; but for high temperatures, where it cannot be read or used under these conditions, the thermometer is calibrated at 4 inches immersion.

Dial thermometers have several advantages over the glass type. They are easy to read and have greater robustness; they are also made on several principles, such as ether vapour, methyl chloride, mercury vapour, alcohol and gas expansion and mercury-in-steel. The last named is superior in robustness and reliability when several sources of error have been eliminated. It is suitable for temperatures between −39° C. and +650° C. and this type of thermometer, made by Negretti and Zambra, is guaranteed to be accurate within ½ per cent. up to 300° C. and with 1 per cent. above that point, besides having a guarantee for a period of two years. In these instruments the Bourdon tube is of a special patented grooved type, to give added strength and longer life, the connecting tube is of extremely fine bore and compensated to avoid the "line" error, and the pointer is attached direct to the centre of the Bourdon tube without quadrants and pinions.

The recording mercury-in-steel thermometers give a permanent record of the fluctuations of temperature, with an indication as to whether the rate of heating is too slow or too fast, whether any over-heating has taken place, or whether the tendency is rising or falling. In this rôle they enable previous conditions to be faithfully reproduced.

Electrical resistance thermometers are of great value for indicating the temperatures (up to 260° C.) from points at some considerable distance from the indicator, and the temperature from any number of points can be read by operating a switch. In addition, further bulbs may be added as desired from time to time. The principle of these instruments is that the electrical resistance of pure metal varies with changes of temperature. The Wheatstone method is adopted, with a galvanometer calibrated in degrees F. or C. A small accumulator operates the galvanometer; alternatively a mains unit can be supplied to operate direct from the electric supply.

Organic Reagents for Metals

Hopkin and Williams, Ltd.

IN January, 1933, Hopkin and Williams, Ltd., published a book of great utility to the analyst, in which seventeen organic reagents for metal were described in practical detail, after having been re-examined in the research laboratory of the company. This publication was so well received that a second impression became necessary within a few months, especially as a comprehensive bibliography for each reagent was included to guide the reader in quest of information on special applications. Among the most interesting and widely used of these special reagents we may mention aluminon which, as a reagent for aluminium has found widespread application in the testing of foodstuffs and water. Cupferron is already well established as a quantitative reagent for iron and titanium, as is dimethylglyoxime for nickel. Diphenylcarbazide and diphenylcarbazone are also of interest as reagents for mercury in minute concentration, particularly in view of the attention directed in recent years to the toxic effects of an atmosphere contaminated with the vapour of this metal.

Since the publication of this book an important addition to this class of reagents has been made. Dithiocarbazone is a useful reagent for lead and certain other metals. It is applied to the direct extraction of traces of lead from an aqueous solution of the sample under test, and is used in chloroform or carbon tetrachloride solution. On shaking this solution with an aqueous solution containing lead the metal forms with the organic substance a compound which is soluble in the organic solvent.

This technique provides a ready method of separation, the subsequent quantitative determination being carried out according to recognised procedure.

Reagents for "Spot" Tests

The British Drug Houses, Ltd.

DURING recent years, analysts in the fields of both pure and applied chemistry, actuated by considerations of economy of time and material, have given increasing attention to the organic reagents which are available for use in the detection and determination of traces of metals and other inorganic substances. Knowledge of this subject has been greatly extended by the investigations of Feigl and others, who have devised a system whereby single drops of the test solutions are employed for qualitative work. By means of this system it is now frequently possible to avoid many of the tedious group separations and to obtain, within a few minutes, evidence of the presence of traces of extraneous materials with greater certainty than was afforded by the older methods. This circumstance, added to the saving of material when only a limited amount is at the disposal of the analyst, yields advantages which are easy to grasp.

A technique peculiar to these tests has been developed by this special branch of qualitative inorganic micro-analysis. These "spot" tests generally involve colour change, or the

formation of characteristic crystals, and the reactions are carried out in micro-test tubes, on a white tile with depressions for drops, on filter paper impregnated with the reagent and dried, or on microscopic slides. Existing information on the subject is presented in a concise and lucid form in " The B.D.H. Book of Reagents for Delicate Analysis and Spot Tests," published by The British Drug Houses, Ltd. This book is also in its second and enlarged edition, and comprises 54 pages wherein the use of about 50 reagents is described. To pick out one item at random, we may quote the reference to *o-p*-Dihydroxybenzene-azo-p-Nitrobenzene :—

" This dyestuff is adsorbed from solutions by magnesium hydroxide with the formation of a sky-blue precipitate or colour. The reagent used is a 0.5 per cent. solution of the dye in 0.25 N sodium hydroxide. The liquid to be tested is slightly acidified with dilute hydrochloric acid, one drop of the reagent added and sufficient sodium hydroxide to impart a strong alkaline reaction. In the presence of magnesium a blue colour or precipitate appears. . . The reaction may be carried out as a spot test in the depression of a porcelain tile. It is not suitable as a spot test for use on filter paper, as in this case the distinction between the purple colour of the alkaline dye and the blue colour due to the presence of magnesium is not sufficiently clear. The sensitivity of the test is 0.01 milligram in a volume of 10 cc."

Ultra-Violet Radiation

British Hanovia Quartz Lamp Co., Ltd.

WITH the development of efficient apparatus, the practical use of ultra-violet radiation in applied chemistry is constantly increasing. Rapid durability tests, spectroscopic research, photo-chemical studies, vitamin synthesis, are a few of the uses to which the research chemist now applies quartz mercury arc lamps, the efficient modern form of ultra-violet generator. In the analytical field, the use of fluorescence with filtered U.V. radiation is such a quick and handy form of test that it now finds use in most laboratories.

The British Hanovia Quartz Lamp Co., Ltd., is the only organisation in the British Empire which specialises entirely in the manufacture and marketing of ultra-violet apparatus for all purposes. For the chemist, there are several different forms of Hanovia lamp to meet different requirements. In instances where the fluorescence test with a filtered U.V. lamp finds use, the same lamp (with fluorescence filter removed) can readily be applied in durability tests and other purposes necessitating unfiltered radiation. A recently introduced model is shown among our illustrations. Known as the Utility analytic lamp, it has filled the need of a simple, yet adequate, outfit at comparatively low cost.

Continental Chemical Notes

THE AUSSIG VEREIN have now installed an electrolytic alkali plant at their cyanamide works in Falkenau (Czecho-Slovakia).

* * *

ANOTHER DRASTIC EXPERIMENT in output restriction is reported from Germany, where the entry of new firms into the common salt extracting industry has been prohibited until December 31, 1938.

* * *

SPONTANEOUS IGNITION OF SOAP POWDER, formerly ascribed for the most part to the presence of free unsaturated fatty acids, is now held by a writer in " Deutsche Parfümerie Zeitung " to follow intense evolution of heat as a result of water absorbtion by the originally water-poor powder.

* * *

A CZECHO-SLOVAKIAN CONCERN, trading as Synthesia, is co-operating with I.C.I., Ltd., reports the " Chemische Industrie," in the construction of a large ammonia factory located at Semtrix with a daily capacity of about 20 tons nitrogen. In addition, nitric acid will be produced from ammonia supplied by the Marianske Hori concern, of Mährisch-Ostrau.

* * *

THE CHEMICAL UTILISATION OF TIMBER has been investigated on behalf of Danish forest owners. The inquiry brought the conclusion that saccharification to molasses for animal feed, and the exploitation of the alcohol (formed at the same time) in the form of a blended motor spirit, was the course the most appropriate to the special circumstances. The commission also spoke favourably of the Tornesch-Scholler wood saccharification process which German trials have shown to yield an excellent pig feed.

* * *

DIRECT CONVERSION OF CASTOR OIL into a lubricant miscible with mineral oils at ordinary temperatures is claimed by a new French process, whereby it is heated *in vacuo* at about 250° C. for 8 to 12 hours in presence of tin oxide. Glycerol distils over as a by-product and the residue which is lacking in drying oil qualities is found to be miscible with mineral oils and to improve their viscosity curves even when present in small proportion. In carrying out the process it is recommended to pass the oil-catalyst mixture—in which the catalyst is kept in suspension by a jet of steam or a stream of inert gas—through a heated vacum apparatus, the rate of flow being so adjusted that the issuing modified oil possesses the desired properties. An alternative method of securing an effective surface of catalyst is to spread the latter *in situ* upon a porous support. (French Patent 760,783.)

ALKALI-FREE BLAST FURNACE SLAG is recommended in glass manufacture (" Die Glashütte," *63*, 604) since it appears to render the molten mass more readily fusible and also functions—owing to its high sulphur content—as a powerful and cheap colouring agent.

* * *

RECOVERY OF LEAD AND COPPER SCRAP from old cables can be facilitated by burning off the jute, bitumen and other organic matter in a non-heated furnace, when the molten lead can be run off leaving a residue of copper wire. The patentees of the process (German Patent 587,149) are Topf and Söhne, of Erfurt.

* * *

EXCEPTIONALLY DEEP BORINGS for common salt are now being undertaken in the Hallein district of Austria where it is hoped to locate very pure salt at a depth of over 3,000 feet. An island of the purest rock salt has already been located. It measures about 13 feet in thickness and 40 feet in diameter and will in itself repay the entire boring expenditure.

* * *

CONTINUED ACCUMULATION OF ARSENICAL ORE stocks at the Boliden mines in Sweden (the total surplus of arsenic is now 100,000 tons) has occasioned the construction of an additional storage shed. Of the 30,000 tons, which is the approximate annual world consumption, about 75 per cent. is used for animal pest preparations. Swedish interests are now inquiring into the possibilities of arsenic compounds in wood impregnation and as an ingredient of certain types of concrete.

* * *

BULGARIAN AUTUNITE, very extensive deposits of which are to hand near the village of Streltscha, has aroused interest as a potential source of radium. This mineral, according to the March issue of " Chimie et Industrie," is a very pure calcium uranyl phosphate and exhibits the valuable feature, from the standpoint of the radium industry, of being free from thorium. Another advantage is its ready solubility in hydrochloric acid. The Bulgarian Government was approached in 1928 and 1929 by foreign interests with a view to a concession being granted, but a decision has been postponed pending closer examination of the deposits. The information disclosed by the writer is based upon a survey commenced two years ago and still in progress. An average uranium oxide content of 52 per cent. was established and the mineral is notable for its freedom from (in addition to thorium) barium or sulphur. By a method described in some detail, radioactive barium sulphate preparations were obtained with a radium content amounting to 89.62×10^{-7} gram per gram of barium sulphate.

Notes and Reports from the Societies

Ceramic Society

Clay Convention and Spring Meeting

THE fifth Clay Convention and the Spring meetings of the Refractory Materials and Building Materials Sections of the Ceramic Society will be held at Llandudno from May 7 to 10. Members of the Pottery Section are cordially invited to these meetings and to support the Clay Convention.

The Convention will be held under the presidency of Lt.-Colonel C. W. Thomas, and the president and committee are anxious that this meeting shall be very successful in every way, and with that aim in view they trust that every manufacturer of clay goods will co-operate with them by making a special endeavour to be present. The convention headquarters will be at the Grand Hotel, which has a delightful position on the Pier and is well appointed for convention purposes. On Tuesday, May, 8, the programme includes the meetings of the Refractory Materials and Building Materials Sections of the Ceramic Society, the luncheon of the Ceramic Society at the Grand Hotel, and the President's reception and dance in the evening. On Wednesday, May 9, there will be a general conference, a civic welcome, and the presidential address. Papers and talks will be given by Sir Raymond Unwin, past-president of the Royal Institute of British Architects and president of the Building Industries National Council, and other well-known speakers, and the opportunity will arise to discuss numerous matters of pressing importance to the clay industries at the present time. The Convention banquet will be held at the Grand Hotel in the evening, followed by dancing. On Thursday, May 10, the annual general meeting of the National Federation of Clay Industries will be held in the morning, followed by the Federation luncheon to all convention members and their ladies.

At a meeting of the Refractory Materials Section, under the chairmanship of Colonel A. Stein, to be held at the Grand Hotel, May 8, the following papers will be read:—"The Permeability of Refractory Materials to Gases. Part IV. The Influence of the Firing Operation on the Permeability to Air of Fireclay Materials" (F. H. Clews and A. T. Green). "Some Factors Affecting Furnace Practice. Part II" (R. J. Sarjant). "Further Investigations on Basic Refractories for Steel Furnaces. Parts I and II" (W. J. Rees and A. H. S. Cross).

The Building Materials will also meet on May 8, at the Grand Hotel, under the chairmanship of Mr. E. Gwynne Vevers, when the following papers will be read:—"The Correlation of Laboratory Tests with the Weathering Properties of Bricks. Part I. Scope of the Investigation and Description of Ground Exposure Test" (B. Butterworth). "Fuel Economy and Ceramic Industry. Part II" (Dr. F. Singer). "The Absorption of Water by Clay Building Bricks and some related Properties" (C. M. Watkins and B. Butterworth). "An Electrically-heated Furnace and its Use in Research on Fired Clay Products" (E. H. Colman).

Society of Chemical Industry

Birmingham Section : Annual Meeting

THE annual meeting of the Birmingham and Midland Section of the Society of Chemical Industry was held at the Birmingham University on April 19, Mr. H. W. Rowell (chairman) presiding. The report, read by Mr. George King, hon. secretary, stated that a noteworthy feature of the past session was the variety of papers of outstanding interest communicated to the Society at joint meetings with the Chemical Engineering, Plastic and Food Groups. As in previous years, members of kindred societies had been invited to the meetings, and, reciprocally, their members had had the opportunity of attending meetings of the Chemical Society, the Institute of Brewing and the Institute of Chemistry. The past year also saw an extension of the social activities of the section.

Members of the committee retiring on June 30 are H. W. Rowell, W. A. Benton, A. J. Broughall, S. R. Carter, T. F. E. Rhead and R. A. V. Tayar; to fill these vacancies, H. N. Beilby, E. L. Hirst, D. W. Parkes, F. G. Broughall and G. Dring, have been elected. On the motion of Mr. G. H. Hill, seconded by Mr. S. Barratt, Mr. A. W. Knapp, M.Sc. (chief chemist, Cadbury Bros., Bournville) was elected chairman for the next two years; Mr. H. W. Rowell (vice-chairman), Mr. W. T. Collis (hon. treasurer), Mr. G. King (hon. secretary), Mr. J. E. Such (hon. recorder), and Mr. J. R. Johnson (hon. auditor).

Mr. Rowell said it was not possible to record much progress in connection with the movement for the union of the various chemical societies. The Manchester Section had taken an active part in trying to organise a protest against the character of the "Journal," and particularly the front portion of it. He regretted that social events were not supported as well as they ought to have been.

Society of Dyers and Colourists

Manchester Section : Annual Meeting

THE annual meeting of the Manchester Section of the Society of Dyers and Colourists was held on April 20, when Mr. W. F. A. Ermen presided. The following were elected officers and members of the committee for the ensuing year: Chairman, W. F. A. Ermen; vice-chairman, L. G. Lawrie; committee, E. B. Adams, Alfred Edge, T. A. Forster, J. R. Hannay, S. Heap, Miss Eva Hibbert, G. E. Holden, W. Marshall, J. W. McMyn, F. Scholefield and L. Thompson..

In his annual report the hon. secretary of the Section (Mr. N. Chappell) stated that the Section had 241 members, 35 associates, and 14 juniors—a total of 290. The corresponding figures for the previous year were 226, 31 and 14, or a total of 271, showing the first increase in membership for eight years.

Oxidising Activity of Sodium Hypochlorite

At the ordinary general meeting which followed, Mr. J. D. Blakeley, M.Sc., F.I.C., read a paper on "The Oxidising Activity of Sodium Hypochlorite." He stated that although hypochlorite solutions had been used as bleaching agents since 1785, when Berthollet first propounded the use of Eau de Javelle, the mechanism of their action had never been really understood, and various suggestions, from the Phlogiston Theory supported by Scheele, to the dynamic equilibrium of modern times, or to the radicals of Kaufman, had been advanced to account for their remarkable behaviour. Previous efforts to elucidate this problem had involved observations on the degree to which some substrate, *e.g.*, cellulose, or a colouring matter, was attacked when immersed in a hypochlorite solution, but such methods introduced an unknown factor which might complicate observations. That this was so was shown by the fact that the maximum attack on cellulose occurred at approximately *pH* 7, whereas most colouring matters, including that of cotton itself, were attacked most vigorously at approximately *pH* 3.

To eliminate these unknown factors, an effort was made to determine the oxidising activity by electrometric means, using buffered solutions containing a fixed amount of hypochlorite. Briefly, the method depended on the fact that when a noble metal was placed in a solution containing an oxidation-reduction system it acquired an electron charge increasing in intensity with increase in reducing tendency of the solution, and while the hypochlorite system was not strictly reversible, so that the ordinary potential equation could not be applied, it was possible to make use of this oxidation potential (by comparison with a standard hydrogen or calomel electrode), as an indicator of the oxidising activity of the solution.

Influence of Vat Dyes

Dealing with "The Influence of Vat Dyes on Hypochlorite Oxidation," Mr. G. M. Nabar, M.Sc., said that various workers had shown that certain vat dyestuffs accelerated oxidation when exposed to light. The dyestuffs which possessed

this accelerating influence appeared, mainly, to be the orange yellow and certain red members of the vat series. Blues and greens, on the other hand, seemed to have very little effect. Of the oxidising agents concerned, greatest attention seemed to have been paid to the part played by atmospheric oxygen and to the action of sodium and calcium hypochlorites, on the "chemick" of the bleacher. This was natural because the oxidation, presumably by atmospheric oxygen in presence of these vat dyestuffs during exposure to light, and the consequent fading of the dyestuff or tendering of the cellulose, might be very serious in a fabric intended for use as a window curtain, furnishing fabric, awning, or similar purpose. Goods which were woven in the grey with vat-dyed stripes might suffer severe tendering in the stripes after bleaching.

This behaviour had been investigated by Scholefield and Patel, Landolt, Nodder and Derrett Smith, and Whittaker, and two important conclusions appeared to have been established, namely (a) severe attack of the cellulose only took place with certain dyestuffs and the red, yellow, and orange vats appeared to be the principal offenders; (b) the tendering was only appreciable when the action of hypochlorite took place in light.

Evaporation and Oxidation

Mr. W. H. Bone, B.Sc., dealt with the subject of "Evaporation and Oxidation." He had made experiments in which strips of cloth were dyed with a number of vat dyestuffs, including Caledon Yellow G, Anthra Yellow GC, Cibanone Orange R, Indanthrene Brilliant Orange GR, Caledon Jade Green, and a mixed dyeing of Anthra Yellow GC and Ciba Blue 2B. These strips were exposed to the Fadeometer arc with one end dipping into a porcelain dish containing tap water. After exposure the samples were topped with Methylene Blue. In each case at a line corresponding to the level reached by the water there was a marked absorption of Methylene Blue. A white control was exposed in a similar manner, and in this case a brown line was produced at the evaporation level. The control on topping with Methylene Blue showed a strong absorption along the brown line. The dry portion of the cloth was tinted much deeper than the wet. Cuprammonium fluidity tests were carried out on the samples, and in every case, even with the white cloth, the cloth was badly tendered along the evaporation line, and tendered more in the dry portion than the wet.

The measurement of the degree of fading was the subject of a paper by Miss M. M. Fitzsimons, B.Sc. (Tech.), who pointed out that attempts to measure the degree of fading could be made in various ways. Subjective methods, namely, estimating the difference in the appearance of the patterns, were suitable for all dyestuffs, but were not entirely satisfactory, as different individuals were liable to get different results. Chemical methods of measuring fading were very limited in application, as most dyestuffs gave very complicated decomposition products. Optical methods could be applied satisfactorily if the dyestuff faded towards a white, as this merely resulted in a flattening of the absorption curve without altering its shape.

Royal Society of Arts

Mr. W. R. Gordon on Coal Utilisation

IN a paper on "The Utilisation of Coal" which he read before the Royal Society of Arts on April 18, Mr. W. R. Gordon, director of the Coal Utilisation Council, said that to a considerable extent the decline of the coal industry was due to the advance of science. But fortunately science was impartial and could be subpœnaed to restore with one hand what she had destroyed with the other. It was, therefore, to science that the coal industry had turned in recent years with ever-increasing confidence and with increasingly encouraging results. There was a long list of methods for the scientific utilisation of coal—a question in which his council was vitally interested. The most ambitious scientific project was the hydrogenation process. Our annual consumption of petrol was over 3,500,000 tons, and if this were to be produced from British coal over 10,000,000 tons would be required, thus giving direct employment to 40,000 miners. The plant at present in course of erection by Imperial Chemical Industries, Ltd., was on a somewhat less ambitious scale; nevertheless, it aimed at the production of 100,000 tons of petrol per annum.

One of the most remarkable changes of the last decade had been the decline in the demand for large coal and the greater utilisation of the small sizes. At one time everybody stipulated for "large"; nowadays some collieries had to resort to crushing the large coal in order to meet the demand for "smalls"—singles, doubles and trebles of the nut sizes. Unfortunately this tended to produce further quantities of slack, of which there were already over large stocks and for which new outlets were required. This was one of the problems upon which science would undoubtedly concentrate increasing attention in the immediate future. Another problem requiring, and receiving, attention was that of coal breakage. Colliery owners and managers now took great pains to see that their coal was put into wagons in the correct size and condition; but it was undeniable that much damage was still done by breakage, especially in loading into and unloading from ships for export.

Institute of the Plastics Industry

Midland Section: Annual Meeting

THE Midlands Section of the Institute of the Plastics Industry will hold its annual general meeting at the Billesley Hotel, Brook Lane, Kings Heath, on May 4, at 7.30 p.m., following which a supper and smoking concert will be held at 8.30 p.m.

Magadi Soda Company

Improved Trading Results

PRESIDING at the annual general meeting of the Magadi Soda Co., Ltd., held in London, on April 20, Mr. J. G. Nicholson, the chairman, drew attention to the improved position of the company since the last meeting. Dealing first with the balance sheet, he pointed out that liquid resources in the form of investments and cash had increased by about £24,000, and stocks of soda ash and general stores showed a drop of about an equal amount as compared with the valuation at the end of 1932. Capital expenditure had been limited to £168 and £5,261 had been spent in developing the production of salt and other chemicals. The profit and loss account showed a loss for the year of £1,434, compared with a loss of £19,505 in 1932, after allocating £16,368 to obsolescence reserve and after payment of the full year's debenture interest at the reduced rate of 4 per cent.

As regards markets generally, Mr. Nicholson pointed out that notwithstanding the improvement in 1933, the position still could not be regarded as satisfactory, and that it was impossible to foresee such decisive increases in sales as would enable the company to rely on its soda business alone. Indeed, the tendency of markets to diminish imports was likely to continue. Soda ash production was lower than in 1932 by 6,500 tons owing to the variation in requirements for stock, but costs had nevertheless been maintained at the previous satisfactory low level.

The sales agreement with Imperial Chemical Industries, Ltd., had operated well in 1933 and was largely instrumental in the comparatively good results obtained; the modified obligations to the Kenya Government were also being more than fulfilled, and negotiations for a new agreement would be initiated shortly.

The manufacture of other products was still being investigated, as well as a promising scheme for reducing fuel costs. A practicable process for producing salt had been devised and would enable substantial quantities to be sold shortly. Bicarbonate of soda was also being produced to meet local market requirements. While, therefore, a return to a dividend-earning basis could not be predicted, the manufacture of salt, etc., would give the company a broader basis on which to work, thus mitigating the effect of reduced sales of soda ash, and there were signs that the results for 1934 would not show a deterioration over those obtained in 1933.

Inventions in the Chemical Industry

Patent Specifications and Applications

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Dates of Application

DYES, manufacture.—Kodak, Ltd. (Eastman Kodak Co.). June 30, 1932. 408,569.

SENSITISING PHOTOGRAPHIC EMULSIONS, process.—Kodak, Ltd. (Eastman Kodak Co.). June 30, 1932. 408,570.

CYANINE DYES, manufacture.—Kodak, Ltd. (Eastman Kodak Co.). June 30, 1932. 408,571.

AZO DYESTUFFS, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). Sept. 29, 1932. 408,590.

RESIN-LIKE PRODUCTS from polybasic acids and polyhydroxy-compounds, process for the manufacture.—R. Burns and Imperial Chemical Industries, Ltd. Oct. 6, 1932. 408,597.

AROMATIC THIO-ACYLAMIDES, production.—J. D. Kendall and Ilford, Ltd. Oct. 6, 1932. 408,638.

HYDROCHLORIC ACID, manufacture.—J. P. Baxter and Imperial Chemical Industries, Ltd. Oct. 7, 1932. 408,578.

ARTIFICIAL RESINOUS COMPOSITIONS, from polyhydric alcohols and polybasic acids.—Imperial Chemical Industries, Ltd., and H. A. Hampton. Oct. 12, 1932. 408,667.

RECOVERY OF SULPHUR.—R. F. Bacon. Dec. 7, 1931. 408,669.

SYMMETRICALLY-SUBSTITUTED AZOBENZENE COMPOUNDS, manufacture.—I. G. Farbenindustrie. Oct. 17, 1931. 408,676.

AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. Oct. 17, 1931. 408,677.

DEHYDRATION OF RESINS.—W. J. Tennant (Bakelite Corporation). Oct. 15, 1932. 408,689.

CELLULOSE DERIVATIVES, preparation.—G. B. Ellis (Soc. des Usines Chimiques Rhone-Poulenc). Nov. 22, 1932. 408,730.

HIGH-MOLECULAR ORGANIC ESTERS, manufacture.—Henkel et Cie, Ges. Jan. 4, 1932. 408,749.

HIGH-MOLECULAR ORGANIC ESTERS, manufacture.—Henkel et Cie, Ges. Jan. 4, 1932. 408,754.

CELLULOSE DERIVATIVES, process of improving.—I. G. Farbenindustrie. April 11, 1932. 408,806.

ARTIFICIAL SPONGES, manufacture.—I. G. Farbenindustrie. Oct. 12, 1932. 408,617.

FINE-GRAINED PRECIPITATES, process and apparatus for producing.—I. G. Farbenindustrie. Oct. 29, 1932. 408,891.

HYDROCARBONS RICH IN CARBON from those poorer in carbon, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). Oct. 12, 1932. 408,691.

Complete Specifications Open to Public Inspection

MONOAZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. Oct. 13, 1932. 27568/33.

DOUBLE COMPOUNDS of the mono-, di-, and trimethylxanthines with salts of camphoric acid, method of preparing.—Syngala Fabrik für Chemisch-Synthetische und Galenische Arzneimittel Ges. Oct. 11, 1932. 27770/33.

ACETATE ARTIFICIAL SILK, dyeing.—Soc. of Chemical Industry in Basle. Oct. 15, 1932. 28090/33.

ACETIC ACID from acetaldehyde, manufacture.—Akt.-Ges. für Stickstoffdünger. Oct. 11, 1932. 28091/33.

RECOVERY OF SULPHUR from hydrogen sulphide.—Girdler Corporation. Oct. 15, 1932. 28595/33.

VAT DYES and intermediates therefor, manufacture.—E. I. du Pont de Nemours and Co. Oct. 15, 1932. 28646/33.

Applications for Patents

HYDROCARBON DERIVATIVES, production.—H. R. Hailes, Imperial Chemical Industries, Ltd., K. S. Jackson and G. E. Wainwright. April 6. 10445.

NITROCELLULOSE PLASTICS.—Imperial Chemical Industries, Ltd. April 6. 10443.

COLOURING OF PAPER.—Imperial Chemical Industries, Ltd., P. T. Gale and F. Hamilton. April 6. 10444.

AMMONIUM NITRATE EXPLOSIVES.—Imperial Chemical Industries, Ltd. April 9. (Germany, April 7, '33.) 10736.

PRINTING INKS.—Imperial Chemical Industries, Ltd. April 10. 10836.

PRODUCTION OF GOODS containing rubber.—International Latex Processes, Ltd. April 7. (United States, May 4, '33.) 10560.

CONCENTRATION or isolation of heavy water.—A. King. April 9. 10735.

MOULDED ARTICLES of resinous materials.—H. E. Potts and Shawinigan Chemicals, Ltd. April 5. (Sept. 12, '33.) 10299.

ISATIN-A-HALIDES, manufacture.—Soc. of Chemical Industry in Basle. April 9. (Switzerland, April 8, '33.) 10667.

INDIGOID DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. April 9. (Switzerland, April 8, '33.) 10668.

DRYING SUBDIVIDED MATERIAL.—Techno-Chemical Laboratories, Ltd. April 10. 10780.

COPPER SALTS, manufacture.—A. Carpmael and I. G. Farbenindustrie. April 14. 11333.

WATER-INSOLUBLE AZO DYESTUFFS, manufacture.—A. Carpmael and I. G. Farbenindustrie. April 17. 11580.

CHLORINATED RUBBER, production.—Chemische Fabrik Buckau. April 18. (Germany, May 26, '33.) 11724.

SHERARDISING.—S. O. Cowper-Coles. April 18. 11636.

PURIFICATION OF SULPHURIC ACID.—E. I. du Pont de Nemours and Co. April 12. (United States, May 2, '33.) 11111.

ORGANIC CONDENSATION PRODUCTS.—E. I. du Pont de Nemours and Co. April 16. (United States, April 14, '33.) 11427.

LACTIC ACID- etc., purification.—Grasselli Chemical Co. April 13. 11173, 11174.

LACQUERS AND COATING AGENTS.—I. G. Farbenindustrie and J. Y. Johnson. April 16. 11429.

VAT DYESTUFFS of anthraquinone series, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. April 16. 11430.

CONDENSATION PRODUCTS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. April 16. 11431.

NEW QUATERNARY AMMONIUM COMPOUNDS, etc., manufacture.—I. G. Farbenindustrie. April 13. (Germany, April 13, '33. 11237, 11238, 11239.

SUBSTANTIVE AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. April 13. (Germany, April 13, '33.) 11240.

WATERPROOFING LEATHER.—Imperial Chemical Industries, Ltd., H. A. Piggott and G. S. J. White. April 12. 11104.

COLOURING OF LEATHER.—Imperial Chemical Industries, Ltd., H. A. Piggott and G. S. J. White. April 12. 11105.

LACQUERS, manufacture and application.—Imperial Chemical Industries, Ltd., and A. A. Harrison. April 12. 11107.

Prices of Chemical Products

This Week's Changes

A FAIR volume of business has been transacted in chemical products this week. A decline in the price of bismuth metal has resulted in price reductions for bismuth salts. A feature of the London market is the continued steadiness in practically all sections. The undertone is quite firm. From the point of view of actual new bookings conditions have been somewhat patchy and irregular on the Manchester market during the week. With the following exceptions, prices remain as reported in pages 341-342 of THE CHEMICAL AGE last week :—

General Chemicals

ACID, OXALIC.—LONDON : £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLANDH 98/100%, £48 to £50 ex store. MANCHESTER : £49 to £53 ex store.

LEAD ACETATE.—LONDON : White, £34 10s. per ton; brown, £1 per ton less. SCOTLAND : White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER : White, £32 to £34; brown, £31.

POTASSIUM CHLORATE.—LONDON : £37 to £40 per ton. SCOTLAND : 99½/100%, powder, £37. MANCHESTER : £38.

SALAMMONIAC.—First lmp spot, £41 17s. 6d. per ton d/d in barrels.

SULPHATE OF COPPER.—MANCHESTER : £14 15s. per ton f.o.b.

Pharmaceutical and Fine Chemicals

ACID, PYROGALLIC.—Cryst., 7s. 6d. per lb.; resublimed, 8s. 6d.

BISMUTH SALTS.—Carbonate, 7s. 4d. per lb.; Citrate, 10s. 1d.; Nitrate (cryst.), 5s. 1d.; Oxide, 11s. 7d.; Salicylate, 8s. 5d.; Subchloride, 11s. 4d.; Subgallate, 8s.; Subnitrate, 6s. 5d.

Intermediates

ACID NAPHTHIONIC.—1s. 8d. per lb.

BENZIDINE, HCL.—2s. 5d. per lb.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DINITROCHLOR BENZENE, SOLID.—£72 per ton.

o-NITRANILINE.—3s. 11d. per lb.

NITRONAPHTHALENE P.G.—1s. 0½d. per lb.

o-TOLUIDINE.—9½d. per lb.

p-TOLUIDINE.—1s. 11d. per lb.

From Week to Week

TO MEET THE CONVENIENCE of a number of tennis players, who, owing to the recent bad weather, have not yet opened their 1934 season, the closing time for entries for THE CHEMICAL AGE Lawn Tennis Tournament has been extended to 9.30 a.m. on Wednesday next, May 2. Entry forms can be obtained on application to the Editor, THE CHEMICAL AGE, Bouverie House, 154 Fleet Street, London, E.C.4. (See page 355.)

MR. L. M. WORLING, C.A., secretary of the Clyde Paper Co., Ltd., Rutherglen, since its incorporation in 1926, has been appointed to a seat on the board of the company.

THE DEATH ROLL from the escape of ammonia at the Billingham works of Imperial Chemical Industries, Ltd., on April 18, now totals eleven.

MR. S. C. JONES, 45 Ludgate Hill, E.C.4, was appointed receiver and manager of Amalgamated British Colours, Ltd., on April 12, under powers contained in a debenture dated March 2, 1934.

THE TWENTY-SIXTH BEDSON LECTURE will be delivered by Professor G. G. Henderson, D.Sc., F.I.C., F.R.S., of the University of Glasgow, in the Chemistry Lecture Theatre of Armstrong College, Newcastle-upon-Tyne, on Friday, May 18, at 6.30 p.m. The subject will be "Gutta Percha, Balata and Caoutchouc."

IN THE COMPANIES COURT, Chancery Division, on Monday, Mr. Justice Bennett again had before him a petition for the compulsory winding up of Arnold and Co. (Sales), Ltd. Counsel for the petitioners stated that the parties had come to terms and he asked that the petition be dismissed without costs. His Lordship made an order accordingly.

OF THE £30,000 REQUIRED FOR THE PURCHASE of the land on which stands the Rothamsted Experimental Station, £26,700 has been given or conditionally promised. The sum of £3,300 remains to be raised before May 12 in order that the station may claim the donation of £15,000 from Mr. Robert McDougall and £5,000 from the Sir Halley Stewart Trust, which will complete the purchase fund.

DAMAGE AMOUNTING TO £1,000 was done at an outbreak of fire in the works of the North British Linoleum Co., Ltd., at Clepington Road, Dundee, on April 16. The outbreak occurred in a drying-store, a steam-heated building in which a large quantity of newly-made linoleum was being dried. Dundee Fire Brigade, although handicapped by the fact that the only entry to the store was by two small doors at either end, managed to prevent the flames spreading among the closely packed linoleum. The effectiveness of the sprinkler installation in the first place kept the fire in check.

A STATEMENT HAS BEEN ISSUED by the Irish Free State Government to the effect that the Government will not be able to purchase any kelp except that gathered before May 1, 1934, and that the price is not likely to be more than £3 per ton. In previous years prices for kelp for iodine manufacture have been as high as £12 to £15 per ton. It is stated that "the extraordinary depression in the market value of iodine resulting from the price-cutting by Japanese, Chilean and other producers, has created a crisis in the kelp industry, and made it impossible to continue on the scale of former years the scheme for the purchase of kelp in Ireland."

EIGHT MEN, INCLUDING TWO DIRECTORS OF THE FIRM, were taken to hospital with severe burns after an explosion at the congoleum works of Michael Nairn and Co., Ltd., in Den Road, Kirkcaldy, Fife, on April 25. The explosion occurred shortly after a fire had broken out in an upper storey of the factory, used for the manufacture of a form of floor covering. The injured men were fighting the outbreak of fire from a roof situated at a lower level, while other workmen were trying to subdue the flames from the interior, when a loud explosion occurred and a great sheet of flame belched from the window on the level of which the men were working.

MELLON INSTITUTE OF INDUSTRIAL RESEARCH has announced that the multiple industrial fellowship on anthracite, established by the Philadelphia and Reading Coal and Iron Co., in 1932, has been continuing its broad programme of research on problems relating to the anthracite industry. So far this work has included studies of the chemical and physical properties of anthracite, new industrial uses, and economic investigations. During the past year a spectrographic examination of anthracite from various seams and collieries was completed. The staff of this Fellowship has also co-operated actively with the research and engineering specialists of the donor company, in planning and conducting systematic investigations pertaining to mining and preparation problems and to domestic and industrial uses of anthracite.

SIR ERNEST J. P. BENN has been appointed chairman of the board of directors of the United Kingdom Provident Institution in succession to the late Lord Revelstoke.

CHEMICAL FERTILISER MANUFACTURERS in the Irish Free State are now producing a new manure from the waste of the sugar beet factories. They are using a formula supplied by the Department of Agriculture.

A BATTERY OF COKE OVENS and the by-product plant of British (Guest, Keen and Baldwins), Ltd., at Dowlais, Merthyr, are to restart, after a break of two and a half years. Work for 300 men will be found.

CHEMICALS AND DRUGS imported into the Irish Free State during February last were valued at £68,870, as compared with £63,031 in the corresponding month of last year. Chemical fertiliser imports increased from £24,054 in February, 1933, to £33,307 in the month under review.

ON HIS RETIREMENT AFTER 50 YEARS' SERVICE with the company as retort foreman, Mr. John Bann has been presented with a chiming clock from the staff and workers of Young's P.L. and Mineral Oil Co., Ltd., at Hopetown Works, Winchburgh. The presentation was made by Mr. James Pentherer, J.P., manager.

THE IMPORTATION OF ALIEN LABOUR in the glass trade is referred to in the quarterly report of the National Flint Glass Makers' Society. The general secretary (Alderman W. Bradford) describing the employment of glass-makers from Germany and Czechoslovakia as "unpleasant and unfair," states that a deputation, introduced by Mr. Alan Stuart Todd, M.P. (Kingswinford), had protested to officials of the Ministry of Labour against the granting of licences to Continental workers while British glass-makers of equal capacities were unemployed, and as a result a number of the imported workers had been displaced by Britons. Letters from glass manufacturers are quoted to show that the society has the support of employers in its action.

SIR HARRY MCGOWAN, chairman and managing director of Imperial Chemical Industries, Ltd., said at the annual meeting of the company last week that the prevention of accidents continued to receive close attention, for the company attached great importance to this work, not only from the humanitarian but also from the economic standpoint. By comparison with the previous year, the number of accidents diminished by 21 per cent., and the number of resultant hours lost fell by 62 per cent. Each year extended and cemented the relationship between those engaged in the several parts of the organisation. They were adopting, as far as possible, the principle of transfer of staff throughout the organisation, not only in order to widen experience, but also so that the personal knowledge and friendships which resulted might ease the solution of the problems which constantly face them.

THE GOVERNMENT OF BOMBAY has been carrying on experiments in order to find a vegetable substitute for imported animal tallow for all types of work in textile mills. The results of these experiments are now published in a bulletin issued by the Industries Department. It is stated that a mixture containing approximately 80 per cent. groundnut oil, 15 per cent. cocoanut oil and 5 per cent. castor oil, suitably treated, gave on hydrogenation a product which has approximately the same chemical and physical constants as imported tallow. It was found, however, that the cost of the product comes to Rs.22 whereas the cost of imported tallow is Rs.19. From this it is clear that the manufacture of the tallow substitute cannot be taken up economically at present, but if the price of tallow goes up or the cost of hydrogenation goes down, it might be possible to manufacture the tallow substitute and sell it at competitive prices.

THE DEATH of Mr. John Lovering, J.P., at "Cosgarne," St. Austell, on Monday morning, at the age of 84 years, removes one of the oldest and most familiar personalities of the china clay industry. He was for many years the senior partner of the firm of John Lovering and Co., noted for china clay and china stone. The firm was founded by Mr. Lovering's father over a century ago, and few were privileged to see the great advance made in china clay production and few assisted in its progress more than Mr. Lovering. Before the slump which fell on the industry in 1930, the firm of Lovering China Clays, Ltd., had a capacity of over 200,000 tons per annum. Through the advancing years and ill-health of Mr. Lovering the family concern was transferred to a limited liability company, and in 1932 the company was absorbed in the English Clays, Lovering, Pochin and Co., Ltd. Mr. Lovering was a member of the old St. Austell School Board which was superseded by the Education Act of 1903. He was a J.P., but rarely attended the sittings of the St. Austell Bench, and was president of the St. Austell Golf Club. He leaves two sons, Mr. J. S. Lovering, who is closely identified with the trade, and Mr. Cecil Lovering, and is survived by three brothers and one sister. The funeral took place at St. Austell on Thursday.

Company News

A. Boake, Roberts and Co.—An interim dividend of 1 per cent., has been declared on the ordinary shares.

Czechoslovakian Explosives Co.—It is reported that the company has decided to declare a 10 per cent. dividend, against 8 per cent. for the previous year.

Goodlass Wall and Lead Industries.—An ordinary dividend of 5 per cent., less tax, is announced for 1933, compared with 3 per cent. for the previous year.

Borax Consolidated, Ltd.—It is announced that the half-yearly coupon No. 70 of preference share warrants to bearer will be paid, less tax at 4s. 6d. in £ on and after May 1, at the offices of the company, King William Street, London.

Graphite Oils Co.—A loss of £4,172 is reported for the year 1933, to which is added the debit balance brought forward of £8,385, removal expenses of £504, making a total debit of £13,061, which it is proposed be carried forward.

Shawinigan Water and Power Co.—For the quarter ended March 31, 1934, the gross revenue was $2,916,779. Operating expenses were $1,241,466, fixed charges $959,296, and surplus before depreciation and tax $716,017.

Ayrton, Saunders and Co.—The report for 1933 shows a balance of £8,225 which with the amount brought in, makes £8,350. After deducting dividends on the 5 per cent. preference shares and on the 7½ per cent. preference shares, depreciation £2,085, there is a debit of £1,478 to be carried forward.

British Tar Products.—A dividend of 6¼ per cent., less tax, is payable on the ordinary and preferred ordinary shares, on April 25.

American Smelting and Refining Co.—A dividend of $4.50 per share on account of accumulations on the first preferred stock, is announced, payable on June 1.

Forthcoming Events

Apr. 28 and **29.**—Chemical Workers' Union. General meeting. Saturday 2.45 p.m. to 5.30 p.m. Sunday 10.30 a.m. until conclusion. Andertons Hotel, Fleet Street, London.

May 2.—Society of Public Analysts. 8 p.m. Burlington House, London.

May 3.—Chemical Society. Discussion on "Unicellular Chemistry," opened by Dr. J. Vargas Eyre. 8 p.m. Burlington House, Piccadilly, London.

May 4.—Institute of the Plastics Industry (Midlands Section). Annual general meeting. Supper and smoking concert. 7.30 p.m. "Billesley Hotel," Brook Lane, Kings Heath.

New Chemical Trade Marks

Compiled from official sources by Gee and Co., patent and trade mark agents, Staple House, 51 and 52 Chancery Lane, London, W.C.2.

Opposition to the registration of the following trade marks can be lodged up to May 18, 1934.

Permaplastic. 549,088. Class 1. Compositions prepared from condensation products of phenol and formaldehyde sold in liquid form for use in manufactures. Brick Trust, Ltd., 1 London Wall Buildings, London, E.C.2. March 1, 1934.

Karvym. 549,409. Class 1. Chemical substances for addition to motor fuel for the purpose of economising consumption. Karvym Products, Ltd., 54 Finsbury Pavement, London, E.C.2. March 12, 1934.

Aretan. 549,165. Class 2. Chemical substances for use in the treatment of soil and for disinfecting seeds, potatoes and bulbs. Bayer Products, Ltd., 31 to 34 Basinghall Street, London, E.C.2. March 3, 1934.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—A firm of manufacturers of distemper and cold-water paints in Cape Town desires to secure the representation of United Kingdom manufacturers of oil paints, varnishes, enamels, turpentine, putty, etc., on a stockist basis, for the Western Cape Province, and for the Orange Free State and the Transvaal if necessary. (Ref. No. 447.)

Argentina.—The Commercial Counsellor to H.M. Embassy at Buenos Aires reports that the Argentine State Oilfields Directorate is calling for tenders, to be presented in Buenos Aires by May 15, 1934, for the supply, delivery and erection of two pumping sets, each consisting of centrifugal pump, electric motor and petrol engine, capable of delivering 33.5 cubic metres per hour. (Ref. G.Y. 13720.)

Argentina.—The Commercial Counsellor to H.M. Embassy at Buenos Aires reports that the Argentine State Oilfields are calling for tenders, to be presented in Buenos Aires by May 15, 1934, for the supply of chemical fire extinguishing appliances. (Ref. No. G.Y. 13717.)

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